

**NORTH CAROLINA DIVISION OF MARINE FISHERIES FIVE-YEAR PROJECT FOR
REOCCURRING FUNDS FROM THE MARINE RESOURCE FUND
JOB 4: FISHERIES INDEPENDENT ASSESSMENT PROGRAM**

Prepared by

Chris Stewart
Garry Wright

North Carolina Division of Marine Fisheries

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ABSTRACT

The Fisheries Independent Assessment program is a stratified random gill net survey designed to provide an index of relative abundance for key recreationally important species in coastal rivers and estuaries each year. Secondary objectives include supplementing existing age, growth and reproductive studies, evaluating catch rates and species distributions to resolve bycatch issues in gill nets, and characterizing habitat use. A total of 462 gillnet samples, including 160 in the Pamlico/Pungo rivers, 160 in the Neuse River, 80 in the New River, 40 in the Cape Fear River, and 24 in the Atlantic Ocean were collected. In all 34,614 individuals, including 83 fish species were captured. In the Pamlico region, Atlantic menhaden (*Brevoortia tyrannus*) was the most abundant species by number (63%). Target species represented 8.8% of the total catch by number and included American shad (*Alosa sapidissima*; <0.1%), Atlantic croaker (*Micropogonias undulatus*; 0.3%), bluefish (*Pomatomus saltatrix*; 2.4%), red drum (*Sciaenops ocellatus*; 0.6%), southern flounder (*Paralichthys lethostigma*; 2.0%), southern kingfish (*Menticirrhus americanus*; <0.1%), Spanish mackerel (*Scomberomorus maculatus*; 0.2%), spot (*Leiostomus xanthurus*; 0.7%), spotted seatrout (*Cynoscion nebulosus*; 0.2%), striped bass (*Morone saxatilis*; 2.3%), and weakfish (*Cynoscion regalis*; <0.1%). In the New and Cape Fear rivers, Atlantic menhaden was the most abundant species by number (44.9%). Target species accounted 21.2% of the total number of individuals and included American shad (<0.1%), Atlantic croaker (0.9%), bluefish (5.4%), red drum (7.0%), southern flounder (4.9%), southern kingfish (0.2%), Spanish mackerel (0.3%), spot (1.4%), spotted seatrout (0.9%), and striped bass (0.1). In the Atlantic Ocean, spiny dogfish (*Squalus acanthias*) was the most abundant species by number (38.6%). Target species accounted for 10.8% of the total number of individuals and included bluefish (1.6%), southern flounder (0.2%), southern kingfish (1.9%), Spanish mackerel (1.4%), spot (2.1%), and weakfish (0.4%). With the exception of bluefish and Spanish mackerel, catch rates for most target species were generally higher in shallow sets. Gill net mortality rates generally were lowest in the winter and highest in the summer. Large mesh gill nets (≥ 5 inches stretch mesh) generally had lower mortality rates than small mesh gill nets. Seasonal mortality ranges for target species in gill nets regardless of mesh size were: American shad (50-100%), Atlantic croaker (0-66%), bluefish (48-100%), red drum (28-68%), southern flounder (0-44%), southern kingfish (83-100%), Spanish mackerel (98-100%), striped bass (47-100%), and weakfish (75-100%). Weighted catch per unit effort (CPUE) estimates were calculated and expressed as an overall CPUE and were partitioned into catch-at-length estimates for all target species by region. For the Pamlico region, only striped bass was above the time-series average; American shad, Atlantic croaker, Bluefish, red drum, southern flounder, southern kingfish, spotted seatrout, Spanish mackerel, spot, and weakfish were below the time-series average. In the Southern region, Atlantic croaker, bluefish, southern flounder, southern kingfish, Spanish mackerel, spot, spotted seatrout, red drum, and weakfish were below the time-series average; and American shad and striped bass were in line with the time-series average. In the Atlantic Ocean American shad, Atlantic croaker, bluefish, red drum, southern flounder, southern kingfish, Spanish mackerel, spot, and weakfish were below the time-series average. Data from this survey are currently being used in several stock assessments including those for red drum, striped bass, spotted seatrout and striped mullet (*Mugil cephalus*).

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GRANT INFORMATION

Project No: 2143-10

Project Title: North Carolina Division of Marine Fisheries Five-Year Project for Reoccurring Funds from the Marine Resource Fund

Grant Duration: Start Date: 1 July 2007 End Date: 30 June 2012

Period Covered by This Report:

Start Date: 1 July 2011 End Date: 30 June 2012

Project Costs:

Proposed CRFL: \$372,496 Grantee: Total: \$372,496

This Period CRFL: \$306,279 Grantee: Total: \$306,279

Study/Job Title: **Job 4: Fisheries Independent Assessment Program**

INTRODUCTION

The Fisheries Reform Act of 1997 established a process for preparing coastal Fisheries Management Plans (FMP) in North Carolina. The goal of these plans is to ensure the long-term viability of the state's economically important species or fisheries. The purpose of this study is to augment the North Carolina Division of Marine Fisheries (NCDMF) ability to collect and analyze essential data used to produce the FMPs for recreationally important species and to help determine overfishing status, levels of spawning stock biomass, mortality, recruitment, and sustainable harvest levels which form the basis for all management actions recommended in FMPs.

The primary objectives of the Fisheries Independent Assessment are to:

1. To calculate annual indices of abundance in major North Carolina rivers and Atlantic Ocean for the following target species: American shad (*Alosa sapidissima*), Atlantic croaker (*Micropogonias undulatus*), bluefish (*Pomatomus saltatrix*), red drum (*Sciaenops ocellatus*), southern flounder (*Paralichthys lethostigma*), southern kingfish (*Menticirrhus americanus*), Spanish mackerel (*Scomberomorus maculatus*), spot (*Leiostomus xanthurus*), spotted seatrout (*Cynoscion nebulosus*), striped bass (*Morone saxatilis*), and weakfish (*Cynoscion regalis*). Catch per unit effort (CPUE) data from fishery independent surveys that standardizes effort will provide an unbiased relative index of abundance to track stock status. Target species may vary by river system.

2. To supplement samples for age, growth, and reproduction studies in order to determine age structure, sex ratios, and relative cohort size for the target species.
3. To evaluate catch rates and species distribution for identifying and resolving management problems in five North Carolina river systems and the Atlantic Ocean.
4. To characterize habitat use in those five river systems.

The goal is to maintain long-term fisheries independent surveys that will provide data on CPUE, catch composition, abundance, size, age, maturity, and mortality in the Neuse, Pamlico, Pungo, New, and Cape Fear rivers and Atlantic Ocean for important recreational species. Maintaining the integrity of and adding to existing times series will provide for improved stock assessments and, through more effective FMPs, the long-term viability of recreational finfish fisheries.

With the initiation of CRFL funds, ongoing Fisheries Independent Assessment (FIA) sampling in the Neuse, Pamlico, and Pungo rivers continued with no break in coverage beginning in October 2007. Similar sampling in the two other rivers (New and Cape Fear) and Atlantic Ocean had not occurred prior to CRFL funding and study personnel and equipment had to be procured and constructed as well as field testing a comparable sampling design suited to the southern area of the state. Hence, actual field sampling in the southern area did not begin until May 2008.

While the CRFL funds are awarded on a fiscal year basis the target species catch rates (and most assessments) are computed on an annual or calendar year basis. This progress report documents sampling completed from July 2011 through June 2012. In addition, annual catch rates, species composition, and other statistics for 2011 (all systems) are computed. Data from adjacent river systems are reported in aggregate (Pamlico area=Pamlico/Pungo and Neuse rivers; Southern area=New and Cape Fear rivers).

SAMPLING PROCEDURES AND ANALYSIS

The FIA employed a stratified-random sampling design based on area and water depth for each area. Sampling in estuarine waters was divided into two regions: the Pamlico Region includes areas of Pamlico River from Washington, North Carolina to the mouth of Pamlico Sound (south of Wade Point) and the Pungo River from Haystack Point and west to Belhaven and south to Jordan Creek; and the Neuse River from New Bern to Oriental, North Carolina (from Old House Point south to Sandy Point); the Southern Region includes the New and Cape Fear rivers. Each region was overlaid with a one-minute by one-minute grid system (equivalent to one square nautical mile) and delineated into shallow (≤ 6 feet) and deep (> 6 feet) strata using bathymetric data from NOAA navigational charts and field observations. NCDMF staff also considered

factors such as obstructions to fishing, safety, and accessibility when evaluating each grid for inclusion in the sampling universe. After grid delineation, the Pamlico/Pungo and Neuse rivers were each segregated into four similar size areas to insure samples were evenly distributed throughout each region (Figure 1). In the Pamlico/Pungo rivers, areas were assigned as follows: upper Pamlico (Washington, NC to Ragged Pt.), middle Pamlico (Ragged Pt. to Gum Pt.), lower Pamlico (Gum Pt. to Wades Pt.), and Pungo (Haystack Pt. south to Sandy Pt). In the Neuse River, areas were assigned as follows: upper Neuse (New Bern to Bay Pt.), upper-middle Neuse (Bay Pt. to Kennel Beach), lower-middle Neuse (Kennel Beach to Wilkinson Pt.), and lower Neuse (Wilkinson Pt. to Gum Thicket Shoal). In the Southern Region areas were assigned as follows: upper New (from Wilson Bay to Hines Point (line extending eastward to French's Creek)) and lower New (Hines Point to the intersection of the New River and the Intracoastal Waterway), the Cape Fear River was considered one area (the northern end of US Army Corps of Engineer's Island 13 south to the mouth of the river).

The Atlantic Ocean was separated into three areas: Topsail Area which was designated from a line extending southwest off New River Inlet south to a line extending southwest off Rich's Inlet; Masonboro Area extended from Rich's Inlet to Frying Pan Shoals; and Brunswick Area extended from Frying Pan Shoals to the North Carolina/South Carolina border.

We used the SAS/STAT® software procedure PLAN to select random sampling grids within each area (SAS Institute 2004). Sampling gear for the Pamlico and Southern regions consisted of an array of gill nets (30-yard segments of 3, 3½, 4, 4½, 5, 5½, 6, and 6½ inch stretched mesh webbing, 240 yards of gill net per sample). Catches from this array of gill nets comprised a single sample, while two samples (one shallow, one deep), totaling 480 yards of gill nets fished, were completed in a sampling trip. Sampling gear for the Atlantic Ocean consisted of an array of gill nets (30-yard segments of 2 ½, 3, 3½, 4, 4½, 5, 5½, 6, and 6½ inch stretched mesh webbing, 270 yards of gill net per sample). If adverse weather conditions or other factors prevented the primary grid in an area from being sampled, alternative grids for that area were randomly selected to increase flexibility and ensure completion of sampling requirements each month. Samples were collected from February 15-December 15 each year. The period of December 16 through February 14 is not sampled due to low catch rates and safety concerns associated with fewer daylight hours and cold water and air temperatures occurring during that period.

Nets were deployed as sink gill nets parallel or perpendicular to the shore based on the strata and common fishing techniques for each area. Gear was deployed within an hour of sunset and fished the following morning to keep soak times at a standard 12 hours. In the Southern region and Atlantic Ocean soak times are reduced to three hours from April through September and deployed with an hour of sunrise (sampling was modified in July 2008). This action was taken to minimize interactions with endangered and threatened sea turtles. Twine size varied between the regions and was based on the twine size most frequently used by local commercial fishermen (Atlantic Ocean: #208 twine or 0.52 mm; Pamlico and Southern: #177 or 0.47mm). All gill nets were constructed with a hanging ratio of 2:1. Nets constructed for shallow strata had a vertical height between six and seven feet. All deep water nets were constructed with a

vertical height between ten and eleven feet. With this configuration, all gill nets were floating and fished the entire water column. In the Cape Fear River only shallow water nets and in the Atlantic Ocean only deep water nets were used.

Physical and environmental conditions including surface and bottom water temperature (°C), salinity (ppt), dissolved oxygen (mg/L), bottom composition, and a qualitative assessment of sediment size were recorded upon retrieval of the nets on each sampling trip. Water temperature, salinity, and dissolved oxygen values are the average of surface and bottom values at deployment and retrieval of nets. All attached submerged aquatic vegetation (SAV) in the immediate sample area was identified to species and density of coverage was estimated visually when possible. Additional habitat data recorded included distance from shore, presence/absence of sea grass or shell, and substrate type.

Each collection of fish (30-yard net) was sorted into individual species groups. All species groups were enumerated and an aggregate weight (nearest 0.01 kilogram (kg)) was obtained for most species. Individuals were measured to the nearest millimeter fork length (FL) or total length (TL) according to morphology of the species.

Selected species were retained and taken to the lab where age structures (otoliths and/or scales) were removed, sex, and maturity stage of gonads were determined. Stomach contents were also collected for several species. Atlantic sturgeon (*Acipenser oxyrinchus*), red drum, and striped bass captured in good condition were tagged and released in support of other NCDMF studies.

Catch rates of target species were calculated annually and expressed as an overall catch per unit effort (CPUE) along with corresponding length class distributions. The overall CPUE gives an estimate of abundance showing availability of each species to the study, while the length distribution shows the size structure of each species for a given year. The overall CPUE was defined as the number of a species of fish captured per sample and was further expressed as the number of a species of fish at length per sample, with a sample being one array of nets. Due to disproportionate sizes of each strata and region, the final CPUE estimate was weighted. The length frequency distribution for each species was weighted by strata and number caught to determine the contribution of each size class to the final weighted CPUE. The total area of each region by strata was quantified using the one-minute by one-minute grid system and then used to weight the observed catches for calculating the abundance indices. The weighting factors by region and strata are:

Pamlico region:

Pamlico/Pungo River 1: Shallow water - 44 square nautical miles

Pamlico/Pungo River 2: Deep water - 38 square nautical miles

Neuse River 1: Shallow water - 36 square nautical miles

Neuse River 2: Deep water – 31 square nautical miles

Southern region:

New River 1: Shallow water - 12 square nautical miles
New River 2: Deep water - 12 square nautical miles
Cape Fear River: Shallow water - 14 square nautical miles

The Atlantic Ocean CPUE was defined as the number of a species of fish captured per sample hour and was further expressed as the number of a species of fish at length per sample hour. Due to disproportionate sizes of each strata and region, the final CPUE estimate was weighted. The total area of each region by strata was quantified using the one-minute by one-minute grid system and then used to weight the observed catches for calculating the abundance indices. The weighting factors by region and for the three areas are:

Atlantic Ocean:

Topsail: 86 square nautical miles

Masonboro: 76 square nautical miles

Brunswick: 90 square nautical miles.

The core samples taken (n=32/month for Pamlico, n=12/month for Southern, and n=6/quarter for Atlantic Ocean) were used in calculations of the annual weighted CPUE index (see Appendix 1 for additional details).

RESULTS

PAMLICO/PUNGO AND NEUSE RIVERS

For the Pamlico/Pungo and Neuse rivers, 32 samples were completed (8 areas x twice a month x 2 samples-shallow and deep) each full month (Figure 1 and Table 1). With the winter hiatus in sampling (16 December- 14 February), 320 samples were obtained yearly. Samples collected in 2011 include 80 shallow and 80 deep samples in the Pamlico/Pungo rivers and 80 shallow and 80 deep samples in the Neuse River (Table 1).

Environmental Data

In 2011 the annual average salinity was similar in the Pamlico/Pungo (mean: 10.2 ppt; range: 0.3-29.1 ppt) and Neuse rivers (mean: 11.3 ppt; range: 0.3-26.4 ppt; Table 2). The highest mean salinity occurred during December for the Pamlico/Pungo rivers (14.0 ppt) and August for the Neuse River (19.1 ppt). The lowest average salinity occurred in April, May, and September for the Pamlico/Pungo rivers (7.3 ppt) and April for Neuse River (6.6 ppt). Water temperature was similar in both areas, ranging from 7.0 to 33.6 °C in the Pamlico/Pungo rivers and 6.8 to 32.7 °C in the Neuse River. The lowest mean monthly water temperature occurred during February for the Pamlico/Pungo and Neuse rivers. The highest mean water temperature occurred during August for both the Pamlico/Pungo and Neuse rivers. The lowest mean dissolved oxygen level occurred in July for Pamlico/Pungo rivers (5.4 mg/L) and in August and September for Neuse River (4.8 mg/L). Dissolved oxygen levels were similar in both regions

throughout the sample year and were generally lower from June-September when water temperature was highest. During June-September in the Neuse River 63% (20 of 32) of deep samples and 31% (10 of 32) of shallow samples were below a threshold of 4.0 mg/L dissolved oxygen. In the Pamlico/Pungo rivers 25% (8 of 32) deep samples and 6% (2 of 32) shallow samples were below 4.0 mg/L dissolved oxygen during June-September. The Pamlico/Pungo and Neuse rivers combined had 44% (28 of 64) deep samples and 16% (10 of 64) shallow samples below 4.0 mg/L dissolved oxygen for June-September.

Species Composition

In 2011 28,474 individuals, including 51 fish species, were collected from 320 samples (Table 3). Atlantic menhaden (*Brevoortia tyrannus*) was the most abundant species and accounted for 63.0% of the total catch by number. Target species represented 8.8% of the total catch by number and included American shad (<0.1%), Atlantic croaker (0.3%), bluefish (2.4%), red drum (0.6%), southern flounder (2.0%), southern kingfish (<0.1%), Spanish mackerel (0.2%), spot (0.7%), spotted seatrout (0.2%), striped bass (2.3%), and weakfish (<0.1%). Anadromous species such as hickory shad (*Alosa mediocris*, 0.6%) and alewife (*Alosa pseudoharengus*, <0.1%) were available to the survey for a short period during their spring spawning migrations. Cownose ray (*Rhinoptera bonasus*, 5.2%) was the most common shark/ray species. Invertebrate species of interest included blue crab (*Callinectes sapidus*, 4.5%) and brown shrimp (*Penaeus aztecus*, <0.1%). Other species of interest present were Atlantic sturgeon (*Acipenser oxyrinchus*, <0.1%), black drum (*Pogonias cromis*, 0.1%), hybrid striped bass (*M. saxatilis x chrysops*, 0.2%), (striped mullet (*Mugil cephalus*, 3.5%) and summer flounder (*Paralichthys dentatus*, <0.1%).

Habitat Use

Species abundance and weighted CPUE estimates for both regions demonstrated higher catch rates in shallow water habitat (≤ 6 ft) versus deep water habitat (> 6 ft) for most of the target species (Table 4). From the 160 shallow and 160 deep samples collected in 2011 (shallow: deep ratio) Atlantic croaker (0.44:0.06), red drum (0.9:0.11), southern flounder (2.98:0.56), spot (0.96:0.26) and striped bass (3.46:0.63) were more abundant in shallow water habitats. Bluefish (1.47:2.79), American shad (0.06:0.09), and Spanish mackerel (0.00:0.26) were more abundant in deep water habitats. Southern kingfish (0.01:0.01), spotted seatrout (0.23:0.14), and weakfish (0.04:0.00) were more evenly distributed between shallow and deep water habitats; however, numbers sampled were low in either habitat.

From the 160 Pamlico/Pungo and 160 Neuse samples collected in 2011 (Pamlico/Pungo: Neuse) southern flounder (2.01:1.67) was the only species more abundant in the Pamlico/Pungo rivers. Red drum (0.1:1.07), spot (0.24:1.1), spotted seatrout (0.12:0.27), and Spanish mackerel (0.02:0.25) were more abundant in the Neuse River. American shad (0.07:0.08), Atlantic croaker (0.21:0.33), bluefish (2.02:2.14), striped bass (2.15:2.14), southern kingfish (0.01:0.01), and weakfish (0.01:0.03) were more evenly distributed between rivers.

Gill Net Mortality and Regulatory Bycatch

In 2011 mortality rates for most target species in large mesh gill nets ($\geq 5''$ stretch mesh) were highest during summer and decreased with lower water temperatures in the spring/fall and winter periods (Table 5). The spring/fall and summer periods had the highest mortality rates for red drum (28-68%), southern flounder (0-36%), spotted seatrout (50%), and striped bass (48-58%). Southern flounder mortality rates ranged from 0% (spring/fall and winter) to 36% (summer). While mortality rates were generally lowest in winter, fewer fish were collected during this period. Red drum over the legal size limit ($>27''$ TL) had mortality rates of 21% in spring/fall and 68% in summer. A 57% mortality rate was observed for sub-legal striped bass ($<18''$ TL) caught in April, May, October, and November. One sub-legal spotted seatrout ($<14''$ TL), one sub-legal Spanish mackerel ($<12''$ FL), and one sub-legal weakfish ($<12''$ TL) were taken in large mesh gill nets, all resulting in mortalities.

In 2011, overall mortality rates by season for small mesh gill nets ($<5''$ stretch mesh) were slightly higher for most target species (Table 6) when compared to the corresponding mortality rates for large mesh gill nets. Mortality rates were highest during spring/fall and summer seasons for Atlantic croaker (60-66%), bluefish (83-92%), red drum (45-46%), spotted seatrout (24-85%), striped bass (68-76%) and weakfish (75%). Southern flounder mortality rates were the lowest ranging from 7% (spring/fall) to 44% (summer). Sub-legal fish taken in small mesh gill nets made up a larger percentage of the overall catch, and generally had higher mortality rates, than did sub-legal fish taken in large mesh gill nets. Sub-legal red drum accounted for 48% of all red drum captured and mortality rates ranged from 14% (summer) to 43% (spring/fall). For all seasons combined, dead sub-legal red drum accounted for 17% of all red drum captured in small mesh gill nets. Sixty-seven red drum were captured above the legal size limit with an overall 52% mortality rate. Small mesh gill net mortality rates for sub-legal striped ranged from 63% (winter) to 79% (summer). Sub-legal striped bass comprised 62% of all striped bass captured in small mesh gill nets. Undersized southern flounder ($<15''$ TL) accounted for 91% of all southern flounder in small mesh captured. Mortality rates for undersized southern flounder ranged from a high of 47% in summer to a low of 0% in winter. Fifteen undersized spotted seatrout were taken by small mesh gill nets, mortality rates ranged from 22% (spring/fall) to 100% (winter). One sub-legal weakfish was caught in small mesh gill nets.

Weighted CPUE and Weighted Size Class Distribution

American shad had an annual weighted CPUE of 0.08 individuals per sample (Table 7). Lengths ranged from 351 to 500 mm TL (Figure 2).

Atlantic croaker had an annual weighted CPUE of 0.26 individuals per sample (Table 7) and was the sixth highest target species. Lengths ranged from 110 to 326 mm TL (Figure 3).

Bluefish was the most abundant target species captured with a weighted CPUE of 2.08 individuals per sample (Table 7). Bluefish ranged from 120 to 510 mm FL, with a mean length of 286 mm FL (Figure 4).

Red drum had a weighted CPUE of 0.53 individuals per sample and was the fifth highest target species (Table 7). Red drum ranged in length from 305 to 1,200 mm FL, with most individuals between 370 and 600 mm FL (Figure 5).

Southern flounder was the third most abundant target species with an annual weighted CPUE of 1.86 individuals per sample (Table 7). Overall lengths ranged from 150 to 518 mm TL, with a mean length of 336 mm TL (Figure 6).

Southern kingfish had an annual weighted CPUE of 0.01 individuals per sample (Table 7). Lengths ranged from 255 to 363 mm TL. Due to low sample size ($n=3$), length frequency was not provided for southern kingfish.

Spanish mackerel had an annual weighted CPUE of 0.12 individuals per sample (Table 7). Lengths ranged from 250 to 480 mm TL, with a mean length of 330 mm TL (Figure 7).

Spot was the fourth most abundant target species with an annual weighted CPUE of 0.63 individuals per sample (Table 7). Sizes ranged from 100 to 268 mm FL with over 80% of the individuals ranging from 200 to 250 mm (Figure 8).

Spotted seatrout weighted CPUE was 0.19 individuals per sample (Table 7). Sizes ranged from 300 to 590 mm FL, with a mean length of 417 mm FL (Figure 9).

Striped bass was the second most abundant target species captured with a weighted CPUE of 2.15 individuals per sample (Table 7). Striped bass ranged from 180 to 905 mm FL, with a mean length of 473 mm FL (Figure 10).

Weakfish annual weighted CPUE was 0.02 individuals per sample (Table 7). Sizes ranged from 258 to 398 mm FL. Due to low sample size ($n=6$), length frequency was not provided for weakfish.

Annual weighted CPUE for target species from 2003 to 2011 for the Pamlico/Pungo and Neuse rivers provide species abundance trends through time (Figure 11). Among target species only striped bass was above the time-series average; American shad, Atlantic croaker, bluefish, red drum, southern flounder, southern kingfish, spotted seatrout, Spanish mackerel, spot, and weakfish were below the time-series average (Table 7).

Collection of Age Structures and Tagging

From February 15 through December 15, 2011, 849 specimens were processed and sent to the age and growth laboratory in Morehead City for analysis. Age structures (otoliths and/or scales)

along with fish length and weight (kg) measurements were collected for each species (Table 8). Age samples collected are incorporated into existing aging programs for each species. Sex and maturity stages were macroscopically determined from gonads and incorporated into existing life history programs. Age samples for American shad, Atlantic croaker, bluefish, red drum, southern flounder, spot, spotted seatrout, Spanish mackerel, striped mullet, and weakfish are available for annual age-length keys. Eighty-seven red drum and 182 striped bass were tagged throughout these rivers.

NEW AND CAPE FEAR RIVERS

For the Southern Region (New and Cape Fear rivers) 12 samples were completed (New River 2 areas x twice a month x 2 samples-shallow and deep and Cape Fear - 1 area x twice a month x 2 shallow samples; Table 9). Eighty samples were collected from the New River in 2011 with 40 from the upper and 40 from the lower (Figure 12). Forty samples were collected from the Cape Fear River. In the first half of 2012, all sampling targets have been reached.

Environmental Data

Environmental parameters were similar among the two river systems in the Southern Region in 2011 (Table 10). Salinities averaged 21.8 ppt and ranged from 3.4 to 35.9 ppt. The highest mean salinity occurred in July in the New River (35.9 ppt) and in August in the Cape Fear River (35.3 ppt). The lowest mean salinity occurred in March in the New River (5.2 ppt) and in April in the Cape Fear River (3.4 ppt). The water temperature in the two river systems averaged 22.6 °C and ranged from 9.6 to 32.8 °C. The warmest mean water temperature occurred in August in the New (32.8 °C) and Cape Fear rivers (31.0 °C). The coldest mean water temperature occurred in December in the New River (9.7 °C) and in February in the Cape Fear River (9.6 °C). The dissolved oxygen averaged 7.6 mg/L and ranged from 4.0 to 10.9 mg/L. The highest mean dissolved oxygen occurred in May in the New River (10.9 mg/L) and in March in the Cape Fear River (10.9 mg/L). The lowest mean dissolved oxygen occurred in September in the New River (4.0 mg/L) and in August and September in the Cape Fear River (5.8 mg/L). The New River typically had lower minimum dissolved oxygen levels than the Cape Fear River from May to August, while the Cape Fear River had higher maximum dissolved oxygen levels during that same time period.

Species Composition

In 2011, 4,345 individuals including 52 fish species were observed (Table 11). The most abundant species by number was Atlantic menhaden (n=1,950) and accounted for 44.9% of the total number of individuals. Target species accounted 21.2% of the total number of individuals and included American shad (<0.1%), Atlantic croaker (0.9%), bluefish (5.4%), red drum (7.0%), southern flounder (4.9%), Spanish mackerel (0.3%), spot (1.4%), spotted seatrout (0.9%), striped bass (0.1) and weakfish (<0.1). The most abundant shark/ray species was the Atlantic sharpnose shark (*Rhizoprionodon terraenovae*, 1.8%). Invertebrate species of interest included

blue crab (10.2) and horseshoe crab (*Limulus polyphemus*, 0.1%). Other species of interest include Atlantic sturgeon (<0.1%), black drum (1.2%), summer flounder (<0.1%), striped mullet (4.5%), and green sea turtle (*Chelonia mydas*, <0.1%).

Habitat Use

The ratio of weighted CPUE for target species (shallow water habitats:deep water habitats) were usually similar among habitats although a higher number of target species had higher weighted CPUEs in shallow water habitats (Table 12). American shad (0.01:0.00), Atlantic croaker (0.43:0.10), red drum (3.73:0.20), southern flounder (1.96:1.38), southern kingfish (0.13:0.00), and striped bass (0.05:0.00) had higher CPUEs in shallow water habitats. Bluefish (3.00:1.43), Spanish mackerel (0.00:0.30), spotted seatrout (0.30:0.43) spot (0.20:1.23) and weakfish (0.00:0.03) had higher CPUEs in deep water habitats.

Gill Net Mortality and Regulatory Bycatch

The small mesh gill nets (<5 inch stretched mesh) had a higher number of individuals and species caught than larger mesh gill nets (≥ 5 inch stretched mesh, Table 13 and 14). In small mesh nets, the mortality rate for target species was usually higher over all seasons (Table 14). Only one American shad was caught in the large mesh gill nets, resulting in a mortality. Mortality rates for Atlantic croaker caught in small mesh nets ranged from 44% (summer) to 56% (spring and fall). In large mesh gill nets, bluefish mortality rates ranged from 48% to 60% and were slightly lower in the summer. Red drum mortality rates were lower in large mesh gillnets, ranging from 30% (summer) to 33% (winter). Red drum caught in small mesh gillnets ranged from 50% (summer) to 54% (winter). Southern flounder had mortalities less than 15% over all seasons in large and small mesh gillnets. Only two southern kingfish were caught in large mesh gillnets. Southern kingfish caught in small mesh gillnets in April, May, October, and November had a mortality rate of 83%. Spanish mackerel had the highest mortality rate (100%) of any species across gears and seasons. The majority of spot were observed in small mesh nets, resulting in no mortalities. Only one spot was observed in large mesh gill nets. Spotted seatrout caught in small mesh nets had mortality rates ranging from 0% (winter) to 50% (spring and fall). Striped bass caught in large mesh gill nets had higher mortality rates (100%) than those caught in small mesh gill nets (50%). Only one weakfish was caught in small mesh gill nets, resulting in a mortality.

A total of 916 individuals from the target species were caught in 2011. Four of the target species (red drum, southern flounder, Spanish mackerel, and spotted seatrout) were under or over legal size limits. Red drum were the most frequently caught sub-legal species (n=117). Small mesh gill nets (n=93) caught more sub-legal drum than large mesh gill nets (n=24). Undersized red drum had mortality rates ranging from 36% in April, May, October, and November to a high of 57% mortality in December, February and March. Only one red drum over the slot limit was caught in the small mesh gill nets. Southern flounder typically had low discard mortality rates in both mesh sizes. The highest discard mortality rate for southern flounder occurred in large mesh gill nets during the summer (15%). Spanish mackerel had two

discards of undersized fish in both small and large mesh gillnets during the summer. In April, May, October, and November a mortality rate of 17% was observed for spotted seatrout in small mesh gill nets. No sublegal weakfish were caught.

Weighted CPUE and Weighted Size Class Distribution

American shad had an annual weighted CPUE of 0.01 individuals per sample in 2011 (Table 15). Only one American shad was caught at 435 mm FL.

Atlantic croaker had an annual weighted CPUE of 0.32 individuals per sample in 2011 (Table 15). Atlantic croaker had a mean size of 233 mm TL and ranged from 140 to 305 mm TL (Figure 13).

Bluefish were the fourth most abundant fish species and had an annual weighted CPUE of 1.92 individuals per sample in 2011 (Table 15). Bluefish had a mean size of 296 mm FL and ranged from 136 to 479 mm FL (Figure 14).

Red drum was the second most abundant fish species and had an annual weighted CPUE of 2.62 individuals per sample in 2011 (Table 15). Red drum had a mean size of 422 mm FL and ranged from 300 to 655 mm FL (Figure 15).

Southern flounder was the fifth most abundant fish species and had an annual weighted CPUE of 1.79 individuals per sample in 2011 (Table 15). Southern flounder had a mean size of 331 mm TL and ranged from 191 to 521 mm TL (Figure 16).

Southern kingfish had an annual weighted CPUE of 0.09 individuals per sample in 2011 (Table 15). Due to low sample size ($n=10$), length frequency was not provided for southern kingfish. The lengths ranged from 294 to 390 mm TL and had a mean size of 345.

Spanish mackerel had an annual weighted CPUE of 0.09 individuals per sample in 2011 (Table 15). Due to low sample size ($n=12$), length frequency was not provided for Spanish mackerel. The lengths ranged from 202 to 520 mm FL and had a mean size of 401 mm FL.

Spot had an annual weighted CPUE of 0.49 individuals per sample in 2011 (Table 15). Spot had a mean size of 222 mm FL and ranged from 110 to 242 mm FL (Figure 17).

Spotted seatrout was the seventh most abundant fish species and had an annual weighted CPUE of 0.34 individuals per sample in 2011 (Table 15). Spotted seatrout had a mean size of 415 mm FL and ranged from 202 to 531 mm FL (Figure 18).

Striped bass had an annual weighted CPUE of 0.01 individuals per sample in 2011 (Table 15). Due to low sample size ($n=4$), length frequency was not provided for striped bass. The lengths ranged from 457 to 635 mm FL and had a mean size of 547.

Only one weakfish was caught at 317 mm FL in 2011 (Table 15).

Annual weighted CPUE for target species from 2008 to 2011 for the Cape Fear and New rivers (Figure 19) provide species abundance trends through time. Among the target species, Atlantic croaker, bluefish, southern flounder, southern kingfish, Spanish mackerel, spot, spotted seatrout, red drum, and weakfish were below the time-series average; and American shad and striped bass were in line with the time-series average (Table 15).

Collection of Age Structures and Tagging

From February 15 through December 15, 2011, 711 specimens were processed and sent to the age and growth laboratory in Morehead City for analysis. Age structures (otoliths and/or scales) were taken from American shad, Atlantic croaker, bluefish, black drum, gulf flounder, red drum, southern flounder, southern kingfish, Spanish mackerel, spot, spotted seatrout, striped mullet, summer flounder, and weakfish along with fish length and weight (kg) measurements (Table 16). Age samples collected were incorporated into existing aging programs for each species. When appropriate sex and maturity stages were macroscopically determined from gonads and incorporated into existing life history programs. Seventy-nine red drum were tagged in the New and Cape Fear rivers. Three sandbar sharks (*Carcharhinus plumbeus*) were tagged in a cooperative agreement with National Marine Fisheries Service COASTSPAN Project.

ATLANTIC OCEAN

For the Atlantic Ocean, 24 samples were completed in 2011 (3 areas twice per quarter during the winter, spring, and fall; and 2 areas during the summer, Table 17). The samples were stratified into three areas: Topsail, Masonboro, and Brunswick (Figure 20). In the first half of 2012, all sampling targets (n=12) have been reached.

Environmental Data

The salinities in the Atlantic Ocean averaged 35.1 ppt on sampling days (Table 18). The highest average salinity occurred in the fall sampling period (October-December, 36.5 ppt). The lowest average salinity occurred in the winter sampling period (January-June, 33.2 ppt). The average temperature was 19.0 °C. The highest average temperatures occurred in the summer sampling period (27.7 °C). The lowest average temperature occurred in the winter sampling period (6.0 °C). The average dissolved oxygen level was 7.8 mg/L. The highest mean dissolved oxygen level occurred in winter period (9.9 mg/L). The lowest mean dissolved oxygen occurred in summer sampling period (6.1 mg/L).

Species Composition

A total of 1,795 individuals were captured in 2011 including individuals from 44 fish species (Table 19). Spiny dogfish was the most abundant species and accounted for 38.6% of the total

catch by number. Target species accounted 10.8% of the total number of individuals and included Atlantic croaker (3.2%), bluefish (1.6%), southern flounder (0.2%), Spanish mackerel (1.4%), spot (2.1%), and weakfish (0.4%). No American shad, red drum, spotted seatrout, or striped bass were caught in the ocean. Sharks and rays accounted for 69.7% of the total catch by number. Invertebrate species of interest included: blue crab (0.2%), horseshoe crab (0.6%), Florida stone crab (0.1%) and white shrimp (0.1%). Other species of interest included Atlantic menhaden (8.1%), Atlantic sturgeon (0.1%), black sea bass (0.1%), sheepshead (0.2%), smooth dogfish (2.1%), and summer flounder (0.1%). Three common loons were also incidentally captured.

Gill Net Mortality and Regulatory Bycatch

Very few target species were observed in the large mesh gill nets (n=6, Table 20). The small mesh gill nets captured 178 individuals of the target species (Table 21). No American shad were caught in both large and small mesh gill nets. Atlantic croaker caught in small mesh gill nets had the highest mortality rate during the summer (50%) and lowest rate in the winter (0%). One Atlantic croaker was caught in large mesh gill nets in spring resulting in a mortality. Only one bluefish was caught in large mesh gill nets in the spring. Bluefish caught in small mesh gill nets had the highest mortality rates in the spring and summer (83%). Soak times in the spring and summer are shorter than fall and winter. No red drum were caught in large mesh gill nets. Only four southern flounder were caught; no mortalities were observed across seasons and gear. Mortality rates for southern kingfish caught in small mesh gill nets ranged from 60% in the fall to 90% in the spring. Mortality rates for Spanish mackerel caught in small mesh gill nets were higher in the summer (100%) than the spring (93%). No Spanish mackerel were caught in large mesh gill nets. Mortality rates of spot ranged from 6% in the fall to 25% in the spring, no spot were caught in large mesh gill nets. No spotted seatrout were caught. One weakfish was caught in large mesh gill nets. Five weakfish were caught in small mesh gill nets, mortality rates were 80% in the fall.

Eight total fish were below legal size limits for three of the target species (southern flounder, Spanish mackerel, and weakfish). Sub-legal southern flounder experienced no mortality at the net. Only three sub-legal Spanish mackerel were caught, 100% mortality was observed in the spring. Sub-legal weakfish (n=4) were only caught in small mesh gillnets during the fall, resulting in mortality rate of 75%.

Weighted CPUE Estimates and Weighted Size Class Distribution

No American shad were caught in the ocean.

Atlantic croaker was the fifth most abundant fish species and had an annual weighted CPUE of 0.25 individuals per sample (Table 22). Atlantic croaker had a mean size of 216 mm TL and ranged from 150 to 236 mm TL (Figure 21).

Bluefish had an annual weighted CPUE of 0.35 individuals per sample (Table 22). Bluefish had a mean size 288 mm FL and ranged from 194 to 350 mm FL (Figure 22).

No drum were caught in the ocean.

Only four southern flounder were caught in the ocean ranging in size from 312 to 470 mm TL (Table 22).

Southern kingfish were the ninth most abundant fish species and had an annual weighted CPUE of 0.23 individuals per sample (Table 22). Southern kingfish had a mean size of 285 mm TL and ranged from 167 to 363 mm TL (Figure 23).

Spanish mackerel had an annual weighted CPUE of 0.34 individuals per sample (Table 22). Spanish mackerel had a mean size of 371 mm FL and ranged from 272 to 512 mm FL (Figure 24).

Spot were the eighth most abundant fish species and had an annual weighted CPUE of 0.13 individuals per sample (Table 22). Spot had a mean size of 190 mm FL and ranged from 178 to 205 mm FL (Figure 25).

No spotted seatrout were caught in the ocean.

No striped bass were caught in the ocean.

Weakfish had an annual weighted CPUE of 0.04 individuals per sample (Table 22). Due to low sample size ($n=7$), length frequency was not provided for weakfish. Weakfish had a mean size of 332 mm FL and ranged from 275 to 431 mm FL.

Annual weighted CPUE for target species from 2008 to 2011 for the Atlantic Ocean (Figure 26) provide species abundance trends through time. Among target species American shad, Atlantic croaker, bluefish, red drum, southern flounder, southern kingfish, Spanish mackerel, spot, and weakfish were below the time-series average (Table 22).

Collection of Age Structures and Tagging

From February through December 2011, 53 specimens were processed and sent to the age and growth laboratory in Morehead City for analysis. Age structures (otoliths and/or scales) were taken from Atlantic croaker, bluefish, northern kingfish, southern flounder, southern kingfish, Spanish mackerel, and weakfish along with fish length and weight (kg) measurements (Table 23). Age samples collected were incorporated into existing aging programs for each species. When appropriate sex and maturity stages were macroscopically determined from gonads and incorporated into existing life history programs.

No striped bass were captured or tagged. One sandbar shark (*Carcharhinus plumbeus*) and six sand tiger sharks (*Carcharias Taurus*) were tagged in a cooperative agreement with National Marine Fisheries Service COASTSPAN Project. Two Atlantic sturgeon were tagged in the Atlantic Ocean off Topsail.

PROTECTED SPECIES INTERACTIONS

Two green sea turtles were caught and released with no signs of injury in the Cape Fear River (Table 24). In 2011, four Atlantic sturgeon were caught and released with no signs of injury, one in the Neuse River, one in the Cape Fear River and two in Onslow Bay. Seven Atlantic sturgeon were captured in 2012; six in Long Bay, resulting in two mortalities (33%) and one in the Neuse river which was released alive. Atlantic sturgeon were listed as endangered on April 6, 2012; all captures occurred prior to their listing.

DEVIATIONS

Pamlico/Pungo and Neuse Rivers

None, all sampling requirements were successfully completed.

New and Cape Fear Rivers

None, all sampling requirements were successfully completed.

Atlantic Ocean

The wrong grid was sampled in the summer season, resulting in four samples being collected from the Topsail area and no samples being collected in the Masonboro area.

PLANNED ACTIVITIES

Pamlico/Pungo and Neuse Rivers

Completion of 32 samples each month, equipment maintenance, data recording and quality control measures, review, and analysis of 2012 data to be reported in 2013 CRFL Progress Report.

New and Cape Fear Rivers

Completion of 12 samples each month, equipment maintenance, data recording and quality control measures, review, and analysis of 2012 data to be reported in 2013 CRFL Progress Report.

Atlantic Ocean

Completion of 6 samples quarterly, equipment maintenance, data recording and quality control measures, review, and analysis of 2012 data to be reported in 2013 CRFL Progress Report.

CONCLUSIONS

The primary objective of this project was to provide a multi-species long-term index of abundance by length and/or age for juvenile and adult fish utilizing the coastal rivers and estuaries in the central and southern areas of the state as well as the near shore Atlantic Ocean. The NCDMF currently has several independent juvenile (young of year) indices throughout the state, but lacks any independent data on indices that track cohorts over time. Full evaluation of such indices takes several years to track a single year class of a species over time. Data in the current study were used to calculate indices of abundance for several recreationally significant species in North Carolina including: red drum, southern flounder, weakfish, spotted seatrout, Atlantic croaker, bluefish, spot, striped bass, and striped mullet. Such indices are now available for assessing trends over time and for use as tuning indices in stock assessments.

An additional utility of this study will be to estimate the abundance of a cohort just prior to entry into a fishery. Such an index may be more reliable than young of year indices because fish can be subject to less predictable and potentially excessive natural mortality rates during their first year of growth. Of particular note may be red drum, which does not recruit to the commercial and recreational fishery until age 2 (18 inches TL). The NCDMF currently estimates year class strength using a seine survey to capture young-of-year. The reliability of the index can be adversely affected by hurricanes and fluctuating water levels during the sampling season and the juveniles can be subjected to high mortality during extremely cold winters making the index less reliable during some years. The current study may provide a more reliable index over time that is not subject to these confounding variables.

BENEFITS

The Fisheries Reform Act of North Carolina requires that North Carolina develop fishery management plans for all commercially and recreationally significant species. The primary benefit of this kind of survey will be realized in the development of fishery management plans once enough years of data are collected to develop long-term indices of abundance. This project will provide independent data to tune and calibrate stock assessments, provide age samples to describe age composition, estimate length and age at maturity, describe habitat use patterns, and define management units for fishery management plans. Data from this project have been used in the development of a state FMP for spotted seatrout and blue crab and will be used in upcoming FMP revisions for estuarine striped bass, striped mullet and southern

flounder. Recent Atlantic States Marine Fisheries Commission (ASMFC) stock assessments for Atlantic croaker, black drum, and red drum have incorporated FIA indices into their assessments. Annual abundance indices are now provided as part of the ASMFC compliance reports for horseshoe crabs, Atlantic sturgeon, bluefish, red drum, and weakfish.

Habitat data, which includes distance from shore, presence/absence of sea grass or shell, and substrate type, have been recorded during this study. Habitat data of this type is an important factor in the NCDMF's analysis to establish Strategic Habitat Areas (SHA) designations. This study has documented capture location and habitat data from 462 samples in 2011 that captured over 90 species of fish and several species of invertebrates. The SHA designation process can combine abundance data with habitat maps to determine the benefit of protecting certain habitats. Currently SHAs are being designated using the MARXAN program which uses decision-based algorithms (Ball et al. 2009). The more data that can be provided to the model, the more likely the results of the model will accomplish the goals of establishing the SHA designation process.

Age and growth studies of several species and tagging studies have been benefited by this program. Aging samples were collected over a wide area and broad time frame to provide information on age composition, seasonal growth patterns, sex ratios, and seasonal maturity throughout the state. Tagging studies conducted in North Carolina now have consistent sampling effort to mark and recapture a variety of fishes including Atlantic sturgeon, red drum, striped bass, and a variety of shark species. This information can be used to describe migration patterns for these species as well as define stock structure and management units for North Carolina and federal fishery management plans. Although the current time frame only encompasses four years of data for the Southern region and Atlantic Ocean, overtime the data collected in the FIA program will provide North Carolina with a sampling program to provide critical data for successful and sustainable fisheries management.

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Table 1. Number of gill net samples collected from February 2011 - June 2012, in Pamlico/Pungo and Neuse rivers, NC. A sample consisted of an array (240-yards) of nets set for 12 hours. Results are broken down by region, area, and depth (shallow ≤ 6 ft and deep > 6 ft).

Year	Month	Stratum	Pamlico/Pungo rivers					Neuse River				
			Area					Area				
			1	2	3	4	All	1	2	3	4	All
2011	Feb	Shallow	1	1	1	1	4	1	1	1	1	4
		Deep	1	1	1	1	4	1	1	1	1	4
	Mar	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Apr	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	May	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Jun	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Jul	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Aug	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Sep	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Oct	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Nov	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Dec	Shallow	1	1	1	1	4	1	1	1	1	4
		Deep	1	1	1	1	4	1	1	1	1	4
	All	Shallow	20	20	20	20	80	20	20	20	20	80
		Deep	20	20	20	20	80	20	20	20	20	80
Total			40	40	40	40	160	40	40	40	40	160
2012	Feb	Shallow	1	1	1	1	4	1	1	1	1	4
		Deep	1	1	1	1	4	1	1	1	1	4
	Mar	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Apr	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	May	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Jun	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
2012	All	Shallow	9	9	9	9	36	9	9	9	9	36
		Deep	9	9	9	9	36	9	9	9	9	36
Total			18	18	18	18	72	18	18	18	18	72

Table 2. Environmental data collected during 2011 by river (Pamlico/Pungo and Neuse rivers) and month from the Fisheries Independent Assessment Program.

Year	River	Month	Salinity (ppt)			DO (mg/L)			Temperature (°C)		
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
2011	Neuse	Feb	8.3	4.0	14.1	10.5	6.2	13.8	9.4	6.8	11.6
		Mar	7.3	0.4	15.7	8.4	3.1	10.8	14.0	11.4	19.4
		Apr	6.6	0.3	20.7	6.9	0.1	10.2	18.8	12.0	24.5
		May	8.4	0.8	17.2	6.2	3.7	10.1	23.5	20.1	29.9
		Jun	13.1	6.6	19.1	6.3	0.1	11.4	28.3	25.5	31.6
		Jul	15.9	7.0	21.6	5.5	1.6	8.5	29.4	27.2	32.6
		Aug	19.1	11.1	26.4	4.8	0.2	9.5	29.8	27.0	32.7
		Sep	8.3	0.5	17.7	4.8	0.3	9.5	25.9	21.5	31.4
		Oct	12.5	5.2	19.1	7.7	1.2	11.4	20.3	17.7	23.2
		Nov	11.8	2.8	19.5	9.9	7.8	13.4	15.4	12.9	17.2
		Dec	11.2	4.3	17.9	9.2	4.0	13.7	13.6	10.8	16.2
		All	11.3	0.3	26.4	7.0	0.1	13.8	21.7	6.8	32.7
2011	Pamlico/Pungo	Feb	10.1	7.1	12.5	10.4	7.9	12.9	9.5	7.0	12.6
		Mar	9.4	4.2	12.4	8.8	3.2	10.9	13.7	9.1	19.2
		Apr	7.3	0.9	12.4	7.6	3.8	10.0	19.7	14.6	25.0
		May	7.3	0.3	12.0	6.8	0.1	12.0	23.5	20.2	29.0
		Jun	9.8	3.6	14.0	5.7	4.1	8.7	28.0	24.9	32.0
		Jul	11.9	5.1	29.1	5.4	0.1	9.9	28.9	14.2	32.8
		Aug	13.1	3.8	18.8	6.6	3.9	11.0	29.6	26.8	33.6
		Sep	7.3	0.5	14.6	5.5	1.1	9.5	25.3	22.7	29.1
		Oct	10.9	6.3	14.2	8.6	4.8	11.9	20.1	16.9	22.7
		Nov	13.1	7.1	16.7	9.0	1.8	11.3	14.5	11.9	17.3
		Dec	14.0	8.2	17.1	9.3	6.8	11.2	12.6	10.2	15.3
		All	10.2	0.3	29.1	7.4	0.1	12.9	21.3	7.0	33.6

Table 3. Species composition from the Pamlico/Pungo and Neuse rivers for 2011.

Species	Common Name	Number		Biomass (kg)	
		Total	Percent	Total	Percent
<i>Brevoortia tyrannus</i>	Atlantic Menhaden	17,936	63.0	1,798.6	20.8
<i>Dorosoma cepedianum</i>	Gizzard Shad	2,151	7.6	940.3	10.9
<i>Rhinoptera bonasus</i> *	Cownose Ray	1,490	5.2	-	-
<i>Callinectes sapidus</i>	Blue Crab	1,288	4.5	210.9	2.4
<i>Lepisosteus osseus</i>	Longnose Gar	1,195	4.2	2,314.6	26.7
<i>Mugil cephalus</i>	Striped Mullet	1,001	3.5	561.1	6.5
<i>Pomatomus saltatrix</i>	Bluefish	683	2.4	269.2	3.1
<i>Morone saxatilis</i>	Striped Bass	653	2.3	1,026.4	11.8
<i>Paralichthys lethostigma</i>	Southern Flounder	561	2.0	290.9	3.4
<i>Morone americana</i>	White Perch	268	0.9	75.7	0.9
<i>Leiostomus xanthurus</i>	Spot	205	0.7	42.5	0.5
<i>Sciaenops ocellatus</i>	Red Drum	176	0.6	471.0	5.4
<i>Alosa mediocris</i>	Hickory Shad	161	0.6	94.4	1.1
<i>Micropogonias undulatus</i>	Atlantic Croaker	82	0.3	16.1	0.2
<i>Lagodon rhomboides</i>	Pinfish	78	0.3	5.7	0.1
<i>Cynoscion nebulosus</i>	Spotted Seatrout	62	0.2	57.7	0.7
<i>Ameiurus catus</i>	White Catfish	51	0.2	63.7	0.7
<i>M. saxatilis</i> x <i>chrysops</i>	Striped Bass X White	50	0.2	40.8	0.5
<i>Elops saurus</i>	Ladyfish	48	0.2	10.5	0.1
<i>Scomberomorus maculatus</i>	Spanish Mackerel	46	0.2	27.9	0.3
<i>Pogonias cromis</i>	Black Drum	41	0.1	35.2	0.4
<i>Bairdiella chrysoura</i>	Silver Perch	31	0.1	2.6	<0.1
<i>Cyprinus carpio</i>	Common Carp	30	0.1	140.1	1.6
<i>Dasyatis sabina</i> *	Atlantic Stingray	27	<0.1	-	-
<i>Alosa sapidissima</i>	American Shad	25	<0.1	32.2	0.4
<i>Ictalurus punctatus</i>	Channel Catfish	22	<0.1	50.4	0.6
<i>Moxostoma</i> spp.	Redhorse Suckers	16	<0.1	16.8	0.2
<i>Amia calva</i>	Bowfin	11	<0.1	19.9	0.2
<i>Micropterus salmoides</i>	Largemouth Bass	11	<0.1	7.5	0.1
<i>Trachinotus carolinus</i>	Florida Pompano	9	<0.1	5.0	0.1
<i>Synodus foetens</i>	Inshore Lizardfish	6	<0.1	1.2	<0.1
<i>Cynoscion regalis</i>	Weakfish	6	<0.1	3.1	<0.1
<i>Peprilus paru</i>	Harvestfish	6	<0.1	0.9	<0.1
<i>Trinectes maculatus</i>	Hogchoker	5	<0.1	0.4	<0.1
<i>Alosa pseudoharengus</i>	Alewife	3	<0.1	0.8	<0.1
<i>Archosargus probatocephalus</i>	Sheepshead	3	<0.1	3.3	<0.1
<i>Menticirrhus americanus</i>	Southern Kingfish	3	<0.1	1.2	<0.1
<i>Chaetodipterus faber</i>	Atlantic Spadefish	3	<0.1	0.6	<0.1
<i>Penaeus aztecus</i>	Brown Shrimp	2	<0.1	0.1	<0.1
<i>Ictalurus furcatus</i>	Blue Catfish	2	<0.1	3.3	<0.1

Table 3 (cont.)

Species	Common Name	Number		Biomass (kg)	
		Total	Percent	Total	Percent
<i>Caranx hippos</i>	Crevalle Jack	2	<0.1	0.2	<0.1
<i>Menticirrhus saxatilis</i>	Northern Kingfish	2	<0.1	0.7	<0.1
<i>Peprilus triacanthus</i>	Butterfish	2	<0.1	0.2	<0.1
<i>Phalacrocorax auritus</i> *	Double-crested Cormorant	2	<0.1	-	-
<i>Raja eglanteria</i> *	Clearnose Skate	1	<0.1	-	-
<i>Acipenser oxyrinchus</i> *	Atlantic Sturgeon	1	<0.1	-	-
<i>Opisthonema oglinum</i>	Atlantic Thread Herring	1	<0.1	0.2	<0.1
<i>Moxostoma macrolepidotum</i>	Shorthead Redhorse	1	<0.1	0.9	<0.1
<i>Pylodictis olivaris</i>	Flathead Catfish	1	<0.1	0.6	<0.1
Belonidae	Needlefishes	1	<0.1	0.2	<0.1
<i>Lepomis gibbosus</i>	Pumpkinseed	1	<0.1	0.2	<0.1
<i>Perca flavescens</i>	Yellow Perch	1	<0.1	0.4	<0.1
<i>Rachycentron canadum</i>	Cobia	1	<0.1	0.3	<0.1
<i>Orthopristis chrysoptera</i>	Pigfish	1	<0.1	0.1	<0.1
<i>Astroscopus</i> spp.	<i>Astroscopus</i> Stargazers	1	<0.1	0.6	<0.1
<i>Paralichthys dentatus</i>	Summer Flounder	1	<0.1	0.8	<0.1
<i>Chelydra serpentina</i>	Common Snapping Turtle	1	<0.1	4.2	<0.1
<i>Chrysemys scripta</i> *	Yellowbelly Turtle	1	<0.1	-	-
<i>Trachemys scripta</i>	Common Slider	1	<0.1	3.5	<0.1
<i>Pelecanus occidentalis</i> *	Brown Pelican	1	<0.1	-	-
<i>Lutra canadensis</i>	River Otter	1	<0.1	5.5	0.1
Cnidaria*	Jellyfish	-	-	-	-
Total		28,472	100	8,661.2	100

*Noted but count and/or weight was not recorded.

Table 4. Species abundance and weighted CPUE (# fish per sample) by region (Pamlico/Pungo and Neuse rivers) and water depth for target species for 2011. Shallow ≤ 6 feet and deep > 6 feet water depth.

Common name	River	Shallow ¹			Deep ¹			Combined ²		
		Total number	CPUE	PSE	Total number	CPUE	PSE	Total number	CPUE	PSE
American shad	Neuse	5	0.06	44	8	0.10	38	13	0.08	25
	Pamlico/Pungo	5	0.06	52	7	0.09	46	12	0.07	43
	Combined	10	0.06	33	15	0.09	33	25	0.08	25
Atlantic croaker	Neuse	45	0.56	31	5	0.06	52	50	0.33	30
	Pamlico/Pungo	27	0.34	28	5	0.06	59	32	0.21	24
	Combined	72	0.44	23	10	0.06	50	82	0.26	19
bluefish	Neuse	102	1.28	30	252	3.15	22	354	2.14	17
	Pamlico/Pungo	130	1.63	39	199	2.49	29	329	2.02	24
	Combined	232	1.47	27	451	2.79	18	683	2.08	15
red drum	Neuse	147	1.84	19	14	0.18	32	161	1.07	18
	Pamlico/Pungo	10	0.13	48	5	0.06	44	15	0.1	30
	Combined	157	0.90	18	19	0.11	27	176	0.53	17
southern flounder	Neuse	218	2.73	31	36	0.45	20	254	1.67	27
	Pamlico/Pungo	255	3.19	21	52	0.65	19	307	2.01	18
	Combined	473	2.98	18	88	0.56	14	561	1.86	16
southern kingfish	Neuse	1	0.01	100	1	0.01	100	2	0.01	100
	Pamlico/Pungo	1	0.01	100	0	0.00	-	1	0.01	100
	Combined	2	0.01	100	1	0.01	100	3	0.01	100
Spanish mackerel	Neuse	0	0.00	-	43	0.54	84	43	0.25	84
	Pamlico/Pungo	0	0.00	-	3	0.04	74	3	0.02	50
	Combined	0	0.00	-	46	0.26	77	46	0.12	75
spot	Neuse	145	1.81	36	22	0.28	28	167	1.1	32
	Pamlico/Pungo	21	0.26	33	17	0.21	30	38	0.24	25
	Combined	166	0.96	31	39	0.26	100	205	0.63	25
spotted seatrout	Neuse	26	0.33	24	17	0.21	36	43	0.27	22
	Pamlico/Pungo	12	0.15	61	7	0.09	36	19	0.12	42

Table 4 (cont.)

Common name	River	Shallow ¹			Deep ¹			Combined ²		
		Total number	CPUE	PSE	Total number	CPUE	PSE	Total number	CPUE	PSE
striped bass	Combined	38	0.23	26	24	0.14	29	62	0.19	21
	Neuse	275	3.44	20	50	0.63	39	325	2.14	18
	Pamlico/Pungo	278	3.48	22	50	0.63	54	328	2.15	20
weakfish	Combined	553	3.46	15	100	0.63	33	653	2.15	13
	Neuse	4	0.05	61	0	0.00	-	4	0.03	67
	Pamlico/Pungo	2	0.03	70	0	0.00	-	2	0.01	100
	Combined	6	0.04	50	0	0.00	-	6	0.02	50

¹- 80 shallow and 80 deep samples collected from each river, 160 shallow and 160 deep samples collected from combined systems

²- 160 samples from the Neuse and 160 samples from the Pamlico/Pungo, 320 combined samples collected during sampling period

Table 5. Mortality rates for target species at net retrieval (12 hour soak times) in large mesh gill nets ($\geq 5''$ stretch mesh) for 2011 in the Pamlico/Pungo and Neuse rivers. Mortality rates are reported overall and for regulatory discards due to size limits*. Separate mortality rates are reported for three seasons spring/fall (Apr-May; Oct-Nov), summer (Jun-Sep), and winter (Dec 1-15; Feb 15-Mar).

Season	Common name	Number collected	Percent dead	Number sub-legal collected	Percent sub-legal dead	Number over legal collected	Percent over legal dead
Spring/Fall	American shad	4	100%	-	-	-	-
	Atlantic croaker	2	56%	-	-	-	-
	bluefish	84	68%	-	-	-	-
	red drum	25	28%	6	50%	19	21%
	southern flounder	74	0%	35	0%	-	-
	southern kingfish	0	-	-	-	-	-
	Spanish mackerel	0	-	-	-	-	-
	spot	1	-	-	-	-	-
	spotted seatrout	0	-	-	-	-	-
	striped bass	154	58%	7	57%	-	-
	weakfish	1	100%	-	-	-	-
Summer	American shad	0	-	-	-	-	-
	Atlantic croaker	5	60%	-	-	-	-
	bluefish	102	85%	-	-	-	-
	red drum	22	68%	-	-	22	68%
	southern flounder	162	36%	109	39%	-	-
	southern kingfish	0	-	-	-	-	-
	Spanish mackerel	1	100%	1	100%	-	-
	spot	4	50%	-	-	-	-
	spotted seatrout	4	50%	1	100%	-	-
	striped bass	25	48%	1	0%	-	-
	weakfish	1	100%	1	100%	-	-
Winter	American shad	6	50%	-	-	-	-
	Atlantic croaker	0	-	-	-	-	-
	bluefish	0	-	-	-	-	-
	red drum	1	0%	1	0%	-	-
	southern flounder	19	0%	14	0%	-	-
	southern kingfish	0	-	-	-	-	-
	Spanish mackerel	0	-	-	-	-	-
	spot	0	-	-	-	-	-
	spotted seatrout	0	-	-	-	-	-
	striped bass	64	47%	1	0%	-	-
	weakfish	0	-	-	-	-	-

*Size Limits

No size limit for American shad, southern kingfish, Atlantic croaker, bluefish, or spot.; Red drum – 18" TL minimum and 27" TL maximum; Southern flounder – 15" TL minimum; Weakfish – 12" TL minimum; Spotted seatrout – 14" TL minimum; Striped bass – 18" TL minimum, Spanish mackerel-12" FL minimum

Table 6. Mortality rates for target species at net retrieval (12 hour soak times) in small mesh gill nets (<5" stretch mesh) for 2011 in the Pamlico/Pungo and Neuse rivers. Mortality rates are reported overall and for regulatory discards due to size limits*. Separate mortality rates are reported for the three seasons spring/fall (Apr-May; Oct-Nov), summer (Jun-Sep), and winter (Dec 1-15; Feb 15-Mar).

Season	Common name	Number collected	Percent dead	Number sub-legal collected	Percent sub-legal dead	Number over legal collected	Percent over legal dead
Spring/Fall	American shad	7	100%	-	-	-	-
	Atlantic croaker	10	60%	-	-	-	-
	bluefish	247	83%	-	-	-	-
	red drum	65	45%	35	43%	30	53%
	southern flounder	69	7%	62	6%	-	-
	southern kingfish	1	100%	-	-	-	-
	Spanish mackerel	3	100%	-	-	-	-
	spot	109	14%	-	-	-	-
	spotted seatrout	29	24%	9	22%	-	-
	striped bass	241	68%	168	67%	-	-
	weakfish	4	75%	1	0%	-	-
Summer	American shad	1	100%	-	-	-	-
	Atlantic croaker	64	66%	-	-	-	-
	bluefish	219	92%	-	-	-	-
	red drum	39	46%	7	14%	32	53%
	southern flounder	220	44%	199	47%	-	-
	southern kingfish	2	100%	-	-	-	-
	Spanish mackerel	42	98%	1	100%	-	-
	spot	69	55%	-	-	-	-
	spotted seatrout	27	85%	4	75%	-	-
	striped bass	112	76%	58	79%	-	-
	weakfish	0	-	-	-	-	-
Winter	American shad	7	71%	-	-	-	-
	Atlantic croaker	0	-	-	-	-	-
	bluefish	5	60%	-	-	-	-
	red drum	24	33%	19	32%	5	40%
	southern flounder	16	0%	16	0%	-	-
	southern kingfish	0	-	-	-	-	-
	Spanish mackerel	0	-	-	-	-	-
	spot	1	100%	-	-	-	-
	spotted seatrout	2	100%	2	100%	-	-
	striped bass	51	59%	27	63%	-	-
	weakfish	0	-	-	-	-	-

*Size Limits

No size limit for American shad, southern kingfish, Atlantic croaker, bluefish, or spot.; Red drum – 18" TL minimum and 27" TL maximum; Southern flounder – 15" TL minimum; Weakfish – 12" TL minimum; Spotted seatrout – 14" TL minimum; Striped bass – 18" TL minimum, Spanish mackerel-12" FL minimum

Table 7. Annual weighted CPUE (individuals per sample), total number collected (n), mean size (mm), size range (mm), and time-series average CPUE for target species during 2011 in the Pamlico/Pungo and Neuse rivers.

Common name	CPUE	PSE*	Number	Mean size (mm)	Size range (mm)	Average CPUE 2003-2011
American shad	0.08	25	25	428	351-500	0.13
Atlantic croaker	0.26	19	82	229	110-326	0.82
bluefish	2.08	15	683	286	120-510	3.53
red drum	0.53	17	176	527	305-1,200	1.95
southern flounder	1.86	16	561	336	150-518	2.48
southern kingfish	0.01	100	3	310	255-363	0.03
Spanish mackerel	0.12	75	46	330	250-480	0.22
spot	0.63	25	205	208	100-268	0.99
spotted seatrout	0.19	21	62	417	300-590	0.43
striped bass	2.15	13	653	473	180-905	1.71
weakfish	0.02	50	6	338	258-398	0.09

*Percent Standard Error (PSE) is a measure of precision

Table 8. Number of specimens collected from the Pamlico/Pungo and Neuse rivers for age determination by species in 2011.

Species	Neuse	Pamlico	Total
alewife	1	2	3
American shad	21	9	30
Atlantic croaker	33	7	40
bluefish	51	24	75
northern kingfish	0	0	0
red drum	5	0	25
summer flounder	0	0	0
southern flounder	94	101	195
southern kingfish	0	0	0
Spanish mackerel	3	1	4
spot	45	8	53
spotted seatrout	13	9	22
striped bass	68	100	168
striped mullet	74	90	164
weakfish	2	0	2
Total	443	406	849

Table 9. Gill net samples collected from February 2011 – June 2012, in New and Cape Fear rivers, NC. A sample consisted of an array (240-yards) of nets set. Results are broken down by river, area, and depth (shallow <6 ft and deep >6 ft).

			New River		Cape Fear		
Year	Month	Stratum	Area		Area		
			1	2	All	1	All
2011	Feb	Shallow	1	1	2	2	2
		Deep	1	1	2	-	-
	Mar	Shallow	2	2	4	4	4
		Deep	2	2	4	-	-
	Apr	Shallow	2	2	4	4	4
		Deep	2	2	4	-	-
	May	Shallow	2	2	4	4	4
		Deep	2	2	4	-	-
	Jun	Shallow	2	2	4	4	4
		Deep	2	2	4	-	-
	Jul	Shallow	2	2	4	4	4
		Deep	2	2	4	-	-
	Aug	Shallow	2	2	4	4	4
		Deep	2	2	4	-	-
	Sep	Shallow	2	2	4	4	4
		Deep	2	2	4	-	-
	Oct	Shallow	2	2	4	4	4
		Deep	2	2	4	-	-
	Nov	Shallow	2	2	4	4	4
		Deep	2	2	4	-	-
	Dec	Shallow	1	1	2	2	2
		Deep	1	1	2	-	-
	All	Shallow	20	20	40	40	40
		Deep	20	20	40	-	-
Total			40	40	80	40	40
2012	Feb	Shallow	1	1	2	2	2
		Deep	1	1	2	-	-
	Mar	Shallow	2	2	4	4	4
		Deep	2	2	4	-	-
	Apr	Shallow	2	2	4	4	4
		Deep	2	2	4	-	-
	May	Shallow	2	2	4	4	4
		Deep	2	2	4	-	-
	Jun	Shallow	2	2	4	4	4
		Deep	2	2	4	-	-
Total			18	18	36	18	18

Table 10. Environmental data collected during 2011 for New and Cape Fear rivers by month from the Fisheries Independent Assessment Program.

River	Year	Season	Salinity			DO			Temp.		
			(ppt)			(mg/L)			(°C)		
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
New	2011	Feb	13.2	7.4	18.7	9.4	7.8	10.2	12.9	11.0	14.7
		Mar	15.7	5.2	26.2	8.9	7.1	10.5	16.2	12.0	20.1
		Apr	18.8	9.5	33.4	7.6	6.2	10.3	23.1	20.7	26.7
		May	21.1	12.5	34.0	7.3	5.8	10.9	26.0	22.2	30.3
		Jun	27.7	21.7	34.3	6.6	4.8	7.7	28.8	26.6	30.3
		Jul	30.6	24.7	35.9	6.1	5.1	6.6	30.3	28.4	31.7
		Aug	28.5	24.3	34.9	8.1	6.4	9.2	30.3	27.8	32.8
		Sep	17.2	10.9	20.0	6.4	4.0	8.2	26.5	22.1	29.8
		Oct	20.3	10.9	25.5	7.7	5.6	9.3	20.5	17.2	22.9
		Nov	22.7	15.5	31.3	8.5	5.9	9.8	15.5	13.6	17.3
		Dec	23.0	20.9	26.3	9.0	7.7	9.9	11.1	9.7	11.9
		All	22.1	5.2	35.9	7.6	4.0	10.9	22.9	9.7	32.8
Cape Fear	2011	Feb	8.3	5.6	12.8	9.5	9.0	9.8	9.9	9.6	10.2
		Mar	21.3	13.2	33.2	9.3	8.1	10.9	13.3	11.3	15.1
		Apr	17.2	3.4	31.9	7.3	5.9	9.3	18.9	15.9	22.4
		May	19.3	14.9	23.7	8.2	6.3	9.6	22.5	21.3	24.1
		Jun	26.4	17.8	34.8	7.2	6.2	10.1	29.1	28.0	30.5
		Jul	27.1	22.3	32.5	6.3	6.1	6.9	29.1	27.8	29.7
		Aug	28.8	23.8	35.3	7.3	5.8	9.3	29.8	27.1	31.0
		Sep	17.5	13.7	20.8	7.1	5.8	8.9	27.4	26.0	29.0
		Oct	20.8	16.8	26.2	7.0	5.9	8.1	21.2	19.8	22.7
		Nov	22.8	21.0	25.3	7.9	7.4	8.3	16.1	14.6	17.0
		Dec	13.0	11.2	15.3	9.3	8.7	9.6	13.5	13.0	14.0
		All	21.2	3.4	35.3	7.7	5.8	10.9	21.9	9.6	31.0
Combined	2011	Feb	11.6	5.6	18.7	9.4	7.8	10.2	11.9	9.6	14.7
		Mar	17.5	5.2	33.2	9.0	7.1	10.9	15.2	11.3	20.1
		Apr	18.2	3.4	33.4	7.5	5.9	10.3	21.7	15.9	26.7
		May	20.5	12.5	34.0	7.6	5.8	10.9	24.8	21.3	30.3
		Jun	27.3	17.8	34.8	6.8	4.8	10.1	28.9	26.6	30.5
		Jul	29.5	22.3	35.9	6.1	5.1	6.9	29.9	27.8	31.7
		Aug	28.6	23.8	35.3	7.8	5.8	9.3	30.1	27.1	32.8
		Sep	17.3	10.9	20.8	6.6	4.0	8.9	26.8	22.1	29.8
		Oct	20.5	10.9	26.2	7.5	5.6	9.3	20.7	17.2	22.9
		Nov	22.7	15.5	31.3	8.3	5.9	9.8	15.7	13.6	17.3
		Dec	19.7	11.2	26.3	9.1	7.7	9.9	11.9	9.7	14.0
		All	21.8	3.4	35.9	7.6	4.0	10.9	22.6	9.6	32.8

Table 11. Species compositions observed in the Fisheries Independent Assessment Program from the New and Cape Fear rivers during 2011.

Species	Common Name	Number		Biomass (kg)	
		Total	Percent	Total	Percent
Brevoortia tyrannus	Atlantic Menhaden	1,950	44.9	185.1	8.0
Callinectes sapidus	Blue Crab	443	10.2	70.6	3.0
Sciaenops ocellatus	Red Drum	306	7.0	305.4	13.1
Lepisosteus osseus	Longnose Gar	264	6.1	628.9	27.1
Pomatomus saltatrix	Bluefish	234	5.4	102.4	4.4
Paralichthys lethostigma	Southern Flounder	213	4.9	105.4	4.5
Mugil cephalus	Striped Mullet	196	4.5	119.0	5.1
Dorosoma cepedianum	Gizzard Shad	105	2.4	56.0	2.4
Rhizoprionodon terraenovae	Atlantic Sharpnose Shark	78	1.8	28.4	1.2
Leiostomus xanthurus	Spot	62	1.4	14.0	0.6
Gymnura micrura	Smooth Butterfly Ray	61	1.4	32.0	1.4
Pogonias cromis	Black Drum	54	1.2	36.0	1.5
Cynoscion nebulosus	Spotted Seatrout	41	0.9	34.1	1.5
Micropogonias undulatus	Atlantic Croaker	38	0.9	7.0	0.3
Elops saurus	Ladyfish	31	0.7	25.9	1.1
Dasyatis sabina	Atlantic Stingray	27	0.6	29.1	1.3
Sphyrna tiburo	Bonnethead Shark	24	0.6	129.1	5.6
Rhinoptera bonasus	Cownose Ray	21	0.5	64.8	2.8
Trachinotus carolinus	Florida Pompano	21	0.5	14.7	0.6
Dasyatis say	Bluntnose Stingray	16	0.4	57.8	2.5
Alosa mediocris	Hickory Shad	15	0.3	5.7	0.2
Lagodon rhomboides	Pinfish	13	0.3	1.3	0.1
Scomberomorus maculatus	Spanish Mackerel	12	0.3	9.5	0.4
Menticirrhus americanus	Southern Kingfish	10	0.2	4.2	0.2
Malaclemys terrapin	Diamondback Turtle	10	0.2	3.0	0.1
Rachycentron canadum	Cobia	9	0.2	6.6	0.3
Ictalurus furcatus	Blue Catfish	8	0.2	23.0	1.0
Archosargus probatocephalus	Sheepshead	8	0.2	8.6	0.4
Carcharhinus isodon	Finetooth Shark	7	0.2	88.9	3.8
Limulus polyphemus	Horseshoe Crab	6	0.1	10.7	0.5
Chaetodipterus faber	Atlantic Spadefish	6	0.1	0.9	<0.1
Orthopristis chrysoptera	Pigfish	5	0.1	1.2	0.1
Carcharhinus plumbeus(milberti)	Sandbar Shark	4	0.1	21.6	0.9
Carcharhinus limbatus	Blacktip Shark	4	0.1	43.5	1.9
Morone saxatilis	Striped Bass	4	0.1	10.6	0.5
Lobotes surinamensis	Atlantic Tripletail	4	0.1	3.6	0.2
Ameiurus catus	White Catfish	3	0.1	5.3	0.2
Selene vomer	Lookdown	3	0.1	0.3	<0.1
Bairdiella chrysoura	Silver Perch	3	0.1	0.2	<0.1

Table 11 (Cont)

Species	Common Name	Number		Biomass (kg)	
		Total	Percent	Total	Percent
<i>Penaeus setiferus</i>	White Shrimp	2	<0.1	0.1	<0.1
<i>Mustelus canis</i>	Smooth Dogfish	2	<0.1	2.0	<0.1
<i>Squalus acanthias</i>	Spiny Dogfish	2	<0.1	4.2	0.2
<i>Dasyatis americana</i>	Southern Stingray	2	<0.1	1.0	<0.1
<i>Caranx hippos</i>	Crevalle Jack	2	<0.1	0.6	<0.1
<i>Paralichthys dentatus</i>	Summer Flounder	2	<0.1	0.3	<0.1
<i>Chelonia mydas</i>	Green Turtle	2	<0.1	6.8	0.3
<i>Penaeus aztecus</i>	Brown Shrimp	1	<0.1	0.1	<0.1
Majidae	Spider Crabs	1	<0.1	0.1	<0.1
<i>Carcharhinus obscurus</i>	Dusky Shark	1	<0.1	2.0	<0.1
<i>Carcharhinus leucas</i>	Bull Shark	1	<0.1	3.6	0.2
<i>Acipenser oxyrinchus</i>	Atlantic Sturgeon	1	<0.1	4.9	0.2
<i>Amia calva</i>	Bowfin	1	<0.1	1.2	<0.1
<i>Alosa sapidissima</i>	American Shad	1	<0.1	1.5	<0.1
<i>Bagre marinus</i>	Gafftopsail Catfish	1	<0.1	0.5	<0.1
<i>Strongylura marina</i>	Atlantic Needlefish	1	<0.1	0.1	<0.1
<i>Stenotomus chrysops</i>	Scup	1	<0.1	0.6	<0.1
<i>Cynoscion regalis</i>	Weakfish	1	<0.1	0.3	<0.1
<i>Peprilus paru</i>	Harvestfish	1	<0.1	0.1	<0.1
Total		4,345	100.0	2,324	100.0

Table 12. Species abundance and weighted CPUE (# fish per sample) in the Southern Region (New and Cape Fear rivers) and water depth for target species from Fisheries Independent Assessment Program in 2011. Shallow < 6 feet and deep > 6 feet.

Common Name	River	Shallow ¹			Deep ¹			Combined ²		
		Total Number	CPUE	PSE	Total Number	CPUE	PSE	Total Number	CPUE	PSE
American shad	New	0	0.00	-	0	0.00	-	0	0.00	-
	Cape Fear	1	0.03	100	-	-	-	1	0.03	100
	Combined	1	0.01	100	0	0.00	-	1	0.01	100
Atlantic croaker	New	18	0.45	31	4	0.01	60	22	0.28	28
	Cape Fear	16	0.40	36	-	-	-	16	0.40	36
	Combined	34	0.43	23	4	0.10	60	38	0.32	22
bluefish	New	83	2.08	30	120	3.00	28	203	2.54	21
	Cape Fear	31	0.78	26	-	-	-	31	0.78	26
	Combined	114	1.43	23	120	3.00	28	234	1.92	18
red drum	New	258	6.45	19	8	0.20	63	266	3.33	21
	Cape Fear	40	1.00	29	-	-	-	40	1.00	29
	Combined	298	3.73	18	8	0.20	63	306	2.62	18
southern flounder	New	84	2.10	22	55	1.38	25	139	1.74	17
	Cape Fear	74	1.85	19	-	-	-	74	1.85	19
	Combined	158	1.96	14	55	1.38	25	213	1.79	12
southern kingfish	New	0	0.00	-	0	0.00	-	0	0.00	-
	Cape Fear	10	0.25	49	-	-	-	10	0.25	49
	Combined	10	0.13	50	0	0.00	-	10	0.09	44
Spanish mackerel	New	0	0.00	-	12	0.30	36	12	0.15	38
	Cape Fear	0	0.00	-	-	-	-	0	0.00	-
	Combined	0	0.00	-	12	0.30	36	12	0.09	33
spot	New	10	0.25	34	49	1.23	75	59	0.74	62
	Cape Fear	3	0.08	74	-	-	-	3	0.08	74
	Combined	13	0.20	32	49	1.23	75	62	0.05	59
spotted seatrout	New	19	0.48	39	17	0.43	49	36	0.45	31
	Cape Fear	5	0.13	42	-	-	-	5	0.13	42
	Combined	24	0.30	33	17	0.43	49	41	0.34	26
striped bass	New	1	0.02	100	0	0.00	-	1	0.01	100
	Cape Fear	3	0.08	74	-	-	-	3	0.08	74
	Combined	2	0.05	61	0	0.00	-	4	0.03	67

Table 12 (Cont)

Common Name	River	Shallow			Deep			Combined		
		Total Number	CPUE	PSE	Total Number	CPUE	PSE	Total Number	CPUE	PSE
weakfish	New	0	0.00	-	1	0.03	100	1	0.01	100
	Cape Fear	0	0.00	-	-	-	-	0	0.00	-
	Combined	0	0.00	-	1	0.03	100	1	0.01	100

¹- 40 shallow and 40 deep samples collected from New River and 40 shallow samples collected from Cape Fear River, 80 shallow and 40 deep samples collected from combined systems

²- 80 samples from the New River and 40 samples from the Cape Fear River, 120 combined samples collected during sampling period

Table 13. Mortality rates for target species at net retrieval in large mesh gill nets ($\geq 5''$ stretch mesh) for 2011 in the Fisheries Independent Assessment Program (New and Cape Fear rivers). Mortality rates are reported overall and for regulatory discards due to size limits. Separate mortality rates are reported for the three seasons spring/fall (Apr-May; Oct-Nov), summer (Jun-Sep), and winter (Dec 1-15; Feb 15-Mar).

Season	Common name	Number collected	Percent dead	Number sub-legal collected	Percent sub-legal dead	Number over legal collected	Percent over legal dead
Spring/Fall	American shad	0	-	-	-	-	-
	Atlantic croaker	0	-	-	-	-	-
	bluefish	35	60	-	-	-	-
	red drum*	22	32	14	36	0	-
	southern flounder*	61	0	34	0	-	-
	southern kingfish	1	0	-	-	-	-
	Spanish mackerel*	0	-	0	-	-	-
	spot	0	-	-	-	-	-
	spotted seatrout*	1	0	1	0	-	-
	striped bass*	2	100	0	-	-	-
	weakfish*	0	-	0	-	-	-
Summer	American shad	0	-	-	-	-	-
	Atlantic croaker	2	0	-	-	-	-
	bluefish	42	48	-	-	-	-
	red drum*	23	30	8	25	0	-
	southern flounder*	34	9	20	15	-	-
	southern kingfish	1	100	-	-	-	-
	Spanish mackerel*	1	100	1	100	-	-
	spot	0	-	-	-	-	-
	spotted seatrout*	2	50	0	-	-	-
	striped bass*	0	-	0	-	-	-
	weakfish*	0	-	0	-	-	-
Winter	American shad	1	100	-	-	-	-
	Atlantic croaker	0	-	-	-	-	-
	bluefish	1	100	-	-	-	-
	red drum*	12	33	2	50	0	-
	southern flounder*	5	0	3	0	-	-
	southern kingfish	0	-	-	-	-	-
	Spanish mackerel*	0	-	0	-	-	-
	spot	1	100	-	-	-	-
	spotted seatrout*	0	-	0	-	-	-
	striped bass*	0	-	0	-	-	-
	weakfish*	0	-	0	-	-	-

*Size Limits

No size limit for American shad, southern kingfish, Atlantic croaker, bluefish, or spot.; Red drum – 18" TL minimum and 27" TL maximum; Southern flounder – 15" TL minimum; Weakfish – 12" TL minimum; Spotted seatrout – 14" TL minimum; Striped bass – No harvest in Cape Fear River and 18" TL minimum in the New River, Spanish mackerel-12" TL minimum

Table 14. Mortality rates for target species at net retrieval in small mesh gill nets (<5" stretch mesh) for 2011 in the Fisheries Independent Assessment Program (New and Cape Fear rivers). Mortality rates are reported overall and for regulatory discards due to size limits. Separate mortality rates are reported for the three seasons spring/fall (Apr-May; Oct-Nov), summer (Jun-Sep), and winter (Dec 1-15; Feb 15-Mar).

Season	Common name	Number collected	Percent dead	Number sub-legal collected	Percent sub-legal dead	Number over legal collected	Percent over legal dead
Spring/Fall	American shad	0	-	0	-	-	-
	Atlantic croaker	9	56	0	-	-	-
	bluefish	67	78	0	-	-	-
	red drum*	134	53	0	-	1	0
	southern flounder*	59	3	54	4	-	-
	southern kingfish	6	83	0	-	-	-
	Spanish mackerel*	2	100	0	-	-	-
	spot	18	0	0	-	-	-
	spotted seatrout*	28	50	6	17	-	-
	striped bass*	2	50	0	-	-	-
	weakfish*	0	-	0	-	-	-
Summer	American shad	0	-	0	-	-	-
	Atlantic croaker	27	44	0	-	-	-
	bluefish	73	71	0	-	-	-
	red drum*	86	50	70	53	-	-
	southern flounder*	45	11	43	12	-	-
	southern kingfish	2	100	0	-	-	-
	Spanish mackerel*	9	100	1	100	-	-
	spot	43	0	0	-	-	-
	spotted seatrout*	4	25	0	-	-	-
	striped bass*	0	-	0	-	-	-
	weakfish*	1	100	0	-	-	-
Winter	American shad	0	-	0	-	-	-
	Atlantic croaker	0	-	0	-	-	-
	bluefish	14	93	0	-	-	-
	red drum*	28	54	23	57	-	-
	southern flounder*	8	0	7	0	-	-
	southern kingfish	0	-	0	-	-	-
	Spanish mackerel*	0	-	0	-	-	-
	spot	0	-	0	-	-	-
	spotted seatrout*	4	0	1	0	-	-
	striped bass*	0	-	0	-	-	-
	weakfish*	1	100	0	-	-	-

*Size Limits

No size limit for American shad, southern kingfish, Atlantic croaker, bluefish, or spot.; Red drum – 18" TL minimum and 27" TL maximum; Southern flounder – 15" TL minimum; Weakfish – 12" TL minimum; Spotted seatrout – 14" TL minimum; Striped bass – No harvest in Cape Fear River and 18" TL minimum in the New River, Spanish mackerel-12" TL minimum

Table 15. Annual weighted CPUE, total number collected (n), mean size (mm), and size range (mm) for target species during 2011 in the Fisheries Independent Assessment Program (New and Cape Fear rivers).

Common name	CPUE	PSE*	Number	Mean size (mm)	Size range (mm)	Average CPUE 2008-2011
American shad	0.01	100	1	435	435-435	0.01
Atlantic croaker	0.32	22	38	233	140-305	0.59
bluefish	1.92	18	234	296	136-479	2.96
red drum	2.62	18	306	422	300-655	3.68
southern flounder	1.79	12	213	331	191-521	2.68
southern kingfish	0.09	44	10	345	294-390	0.11
Spanish mackerel	0.09	33	12	401	202-520	0.26
spot	0.49	59	62	222	110-242	0.65
spotted seatrout	0.34	26	41	415	202-531	0.70
striped bass	0.03	67	4	547	457-635	0.03
weakfish	0.01	100	1	317	317-317	0.03

*Percent Standard Error (PSE) is a measure of precision

Table 16. Number of specimens collected from the Fisheries Independent Assessment Program (New and Cape Fear rivers) for age determination by species in 2011.

Common name	New River	Cape Fear	Total
American shad	0	1	1
Atlantic croaker	7	9	16
bluefish	122	21	143
black drum	32	7	39
red drum	90	22	112
southern flounder	117	79	196
southern kingfish	0	8	8
Spanish mackerel	9	0	9
spot	11	1	12
spotted seatrout	36	5	41
striped mullet	120	11	131
summer flounder	0	2	2
weakfish	1	0	1
Total	545	166	711

Table 17. Gill net samples collected from May 2011 to June 2012 in the Atlantic Ocean. A sample consisted of an array of nets (270-yards). Results are broken down by area. Winter=January-March, Spring=April-June, Summer=July-September, Fall=October-December.

Year	Season	Area			
		Topsail	Masonboro	Brunswick	Combined
2011	Winter	2	2	2	6
	Spring	2	2	2	6
	Summer	4	0	2	6
	Fall	2	2	2	6
	All	10	6	8	24
2012	Winter	2	2	2	6
	Spring	2	2	2	6
	All	4	4	4	12
Total		14	10	12	36

Table 18. Environmental data collected during 2011 for the Atlantic Ocean by month from the Fisheries Independent Assessment Program. Spring=April-June, Summer=July-September, Fall=October-December.

Area	Season	Salinity (ppt)			DO (mg/L)			Temperature (C)		
		Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Topsail	Winter	34.4	34.3	34.4	7.9	7.1	8.5	13.1	12.8	13.3
	Spring	34.9	34.8	34.9	7.1	6.7	7.3	21.5	21.2	21.8
	Summer†	36.2	36.1	36.4	7.0	5.0	8.7	27.7	27.0	28.5
	Fall	35.5	34.5	35.7	9.2	8.7	9.6	13.3	12.9	13.6
	All	35.4	34.3	36.4	7.7	5.0	9.6	20.7	12.8	28.5
Masonboro	Winter	35.5	35.4	35.9	9.9	9.7	10.2	6.0	5.6	6.4
	Spring	34.2	31.8	34.7	7.1	6.4	9.7	20.7	20.4	20.9
	Summer*	-	-	-	-	-	-	-	-	-
	Fall	35.7	34.9	35.9	7.6	7.1	8.1	20.7	20.4	21.2
	All	35.1	31.8	35.9	8.2	6.4	10.2	15.8	5.6	21.2
Brunswick	Winter	33.2	31.1	34.8	9.4	8.8	9.9	7.8	7.1	8.3
	Spring	34.0	33.7	34.3	7.9	7.5	8.2	27.1	25.9	27.7
	Summer	35.3	34.5	35.6	6.1	4.6	6.8	27.0	26.7	27.2
	Fall	36.5	36.2	36.6	7.9	7.2	8.9	15.2	14.9	15.5
	All	34.7	31.1	36.6	7.8	4.6	9.9	19.3	7.1	27.7
Combined	Winter	34.4	31.1	35.9	9.1	7.1	10.2	9.0	5.6	13.3
	Spring	34.3	31.8	34.9	7.3	6.4	9.7	23.1	20.4	27.7
	Summer	35.9	34.5	36.6	8.2	7.1	9.6	16.4	12.9	21.2
	Fall	35.9	34.5	36.4	6.7	4.6	8.7	27.5	26.7	28.5
	All	35.1	31.1	36.6	7.8	4.6	10.2	19.0	5.6	28.5

*Sample not collected, wrong grid sampled

†Extra sample collected

Table 19. Species composition from Atlantic Ocean from the Fisheries Independent Assessment Program for 2011.

	Common name	Number		Biomass (kg)	
		Total	Percent	Total	Percent
<i>Squalus acanthias</i>	Spiny Dogfish	692	38.6	2301.4	49.6
<i>Rhizoprionodon terraenovae</i>	Atlantic Sharpnose Shark	346	19.3	943.5	20.3
<i>Brevoortia tyrannus</i>	Atlantic Menhaden	145	8.1	20.1	0.4
<i>Chloroscombrus chrysurus</i>	Atlantic Bumper	59	3.3	4.4	0.1
<i>Micropogonias undulatus</i>	Atlantic Croaker	57	3.2	6.3	0.1
<i>Gymnura micrura</i>	Smooth Butterfly Ray	43	2.4	36.3	0.8
<i>Mustelus canis</i>	Smooth Dogfish	38	2.1	146.3	3.2
<i>Leiostomus xanthurus</i>	Spot	37	2.1	4.3	0.1
<i>Menticirrhus americanus</i>	Southern Kingfish	35	1.9	8.9	0.2
<i>Sphyrna tiburo</i>	Bonnethead Shark	33	1.8	191.4	4.1
<i>Peprilus triacanthus</i>	Butterfish	32	1.8	2.3	<0.1
<i>Myliobatis freminvillei</i>	Bullnose Ray	30	1.7	91.1	2.0
<i>Pomatomus saltatrix</i>	Bluefish	28	1.6	9.2	0.2
<i>Scomberomorus maculatus</i>	Spanish Mackerel	26	1.4	12.8	0.3
<i>Raja eglanteria</i>	Clearnose Skate	23	1.3	19.1	0.4
<i>Larimus fasciatus</i>	Banded Drum	15	0.8	1.9	<0.1
<i>Limulus polyphemus</i>	Horseshoe Crab	11	0.6	18.7	0.4
<i>Carcharhinus brevipinna</i>	Spinner Shark	11	0.6	181.2	3.9
<i>Alosa mediocris</i>	Hickory Shad	11	0.6	4.8	0.1
<i>Opisthonema oglinum</i>	Atlantic Thread Herring	11	0.6	1.0	<0.1
<i>Carcharhinus acronotus</i>	Blacknose Shark	8	0.4	103.1	2.2
<i>Sphyrna lewini</i>	Scalloped Hammerhead	8	0.4	34.1	0.7
<i>Majidae</i>	Spider Crabs	7	0.4	0.9	<0.1
<i>Carcharhinus limbatus</i>	Blacktip Shark	7	0.4	116.0	2.5
<i>Cynoscion regalis</i>	Weakfish	7	0.4	2.8	<0.1
<i>Carcharias taurus</i>	Sand Tiger Shark	6	0.3	304.7	6.6
<i>Lagodon rhomboides</i>	Pinfish	6	0.3	0.5	<0.1
<i>Peprilus paru</i>	Harvestfish	6	0.3	0.5	<0.1
<i>Portunus spinimanus</i>	Blotched Swimming Crab	5	0.3	0.3	<0.1
<i>Selene setapinnis</i>	Atlantic Moonfish	5	0.3	0.6	<0.1
<i>Callinectes sapidus</i>	Blue Crab	4	0.2	0.8	<0.1
<i>Stenotomus caprinus</i>	Longspine Porgy	4	0.2	0.3	<0.1
<i>Archosargus probatocephalus</i>	Sheepshead	4	0.2	7.7	0.2
<i>Paralichthys lethostigma</i>	Southern Flounder	4	0.2	3.5	0.1
<i>Calappa flammea</i>	Flame Box Crab	3	0.2	0.2	<0.1
<i>Dasyatis sabina</i>	Atlantic Stingray	3	0.2	3.2	0.1
<i>Dasyatis say</i>	Bluntnose Stingray	3	0.2	1.9	<0.1
<i>Synodus foetens</i>	Inshore Lizardfish	3	0.2	0.8	<0.1
<i>Gavia immer</i>	Common Loon	3	0.2	4.0	0.1
<i>Acipenser oxyrinchus</i>	Atlantic Sturgeon	2	0.1	5.8	0.1
<i>Orthopristis chrysoptera</i>	Pigfish	2	0.1	0.4	<0.1
<i>Stenotomus chrysops</i>	Scup	2	0.1	0.2	<0.1
<i>Penaeus setiferus</i>	White Shrimp	1	<0.1	0.1	<0.1
<i>Menippe mercenaria</i>	Florida Stone Crab	1	<0.1	0.4	<0.1
<i>Cynoscion nothus</i>	Silver Seatrout	1	<0.1	0.2	<0.1
<i>Menticirrhus saxatilis</i>	Northern Kingfish	1	<0.1	0.3	<0.1
<i>Stromateidae</i>	Butterfishes	1	<0.1	0.1	<0.1

Table 19 (Cont)

		Number		Biomass (kg)	
		Total	Percent	Total	Percent
<i>Citharichthys spilopterus</i>	Bay Whiff	1	<0.1	0.1	<0.1
<i>Paralichthys dentatus</i>	Summer Flounder	1	<0.1	0.1	<0.1
<i>Scophthalmus aquosus</i>	Windowpane	1	<0.1	0.1	<0.1
Total		1,795	100.0	4,643.3	100.0

Table 20. Mortality rates for target species at net retrieval in large mesh gill nets ($\geq 5''$ stretch mesh) for 2011 in the Fisheries Independent Assessment Program (Atlantic Ocean). Mortality rates are reported overall and for regulatory discards due to size limits. Separate mortality rates are reported for the four seasons winter (January-March), spring (May and June), summer (July-September), and fall (October-December).

Season	Common name	Total Number	Percent dead	Number sub-legal collected	Percent sub-legal dead	Number over legal collected	Percent over legal dead
Winter	American shad	0	-	0	-	-	-
	Atlantic croaker	0	-	0	-	-	-
	bluefish	0	-	0	-	-	-
	red drum*	0	-	0	-	0	-
	southern flounder*	0	-	0	-	-	-
	southern kingfish	0	-	0	-	-	-
	Spanish mackerel*	0	-	0	-	-	-
	spot	0	-	0	-	-	-
	spotted seatrout*	0	-	0	-	-	-
	striped bass*	0	-	0	-	-	-
	weakfish*	0	-	0	-	-	-
Spring	American shad	0	-	0	-	-	-
	Atlantic croaker	1	100	0	-	-	-
	bluefish	1	0	0	-	-	-
	red drum*	0	-	0	-	0	-
	southern flounder*	1	0	0	-	-	-
	southern kingfish	0	-	0	-	-	-
	Spanish mackerel*	0	-	0	-	-	-
	spot	0	-	0	-	-	-
	spotted seatrout*	0	-	0	-	-	-
	striped bass*	0	-	0	-	-	-
	weakfish*	0	-	0	-	-	-
Summer	American shad	0	-	0	-	-	-
	Atlantic croaker	0	-	0	-	-	-
	bluefish	0	-	0	-	-	-
	red drum*	0	-	0	-	0	-
	southern flounder*	1	0	0	-	-	-
	southern kingfish	0	-	0	-	-	-
	Spanish mackerel*	0	-	0	-	-	-
	spot	0	-	0	-	-	-
	spotted seatrout*	0	-	0	-	-	-

Table 20 (Cont)

Season	Common name	Total Number	Percent dead	Number sub-legal collected	Percent sub-legal dead	Number over legal collected	Percent over legal dead
Fall	striped bass*	0	-	0	-	-	-
	weakfish*	0	-	0	-	-	-
	American shad	0	-	0	-	-	-
	Atlantic croaker	0	-	0	-	-	-
	bluefish	0	-	0	-	-	-
	red drum*	0	-	0	-	0	-
	southern flounder*	1	0	0	-	-	-
	southern kingfish	0	-	0	-	-	-
	Spanish mackerel*	0	-	0	-	-	-
	spot	0	-	0	-	-	-
	spotted seatrout*	0	-	0	-	-	-
	striped bass*	0	-	0	-	-	-
	Weakfish*	1	0	0	-	-	-

*Size Limits

No size limit for American shad, southern kingfish, Atlantic croaker, bluefish, or spot.; Red drum – 18" TL minimum and 27" TL maximum; Southern flounder – 15" TL minimum; Weakfish – 12" TL minimum; Spotted seatrout – 14" TL minimum; Striped bass – No harvest in Cape Fear River and 18" TL minimum in the Atlantic Ocean, Spanish mackerel-12" TL minimum

Table 21. Mortality rates for target species at net retrieval in small mesh gill nets (<5" stretch mesh) for 2011 in the Fisheries Independent Assessment Program (Atlantic Ocean). Mortality rates are reported overall and for regulatory discards due to size limits. Separate mortality rates are reported for the four seasons winter (January-March), spring (May and June), summer (July-September), and fall (October-December).

Season	Common name	Number collected	Percent dead	Number sub-legal collected	Percent sub-legal dead	Number over legal collected	Percent over legal dead
Winter	American shad	0	-	0	-	-	-
	Atlantic croaker	38	0	0	-	-	-
	bluefish	0	-	0	-	-	-
	red drum*	0	-	0	-	0	-
	southern flounder*	0	-	0	-	-	-
	southern kingfish	9	78	0	-	-	-
	Spanish mackerel*	0	-	0	-	-	-
	spot	0	-	0	-	-	-
	spotted seatrout*	0	-	0	-	-	-
	striped bass*	0	-	0	-	-	-
	weakfish*	0	-	0	-	-	-
Spring	American shad	0	-	0	-	-	-
	Atlantic croaker	6	17	0	-	-	-
	bluefish	18	83	0	-	-	-
	red drum*	0	-	0	-	0	-
	southern flounder*	0	-	0	-	-	-
	southern kingfish	10	90	0	-	-	-
	Spanish mackerel*	15	93	3	100	-	-
	spot	4	25	0	-	-	-
	spotted seatrout*	0	-	0	-	-	-

Table 21 (cont)

Season	Common name	Number collected	Percent dead	Number sub-legal collected	Percent sub-legal dead	Number over legal collected	Percent over legal dead
Summer	striped bass*	0	-	0	-	-	-
	weakfish*	0	-	0	-	-	-
	American shad	0	-	0	-	-	-
	Atlantic croaker	4	50	0	-	-	-
	bluefish	6	83	0	-	-	-
	red drum*	0	-	0	-	0	-
	southern flounder*	0	-	0	-	-	-
	southern kingfish	0	-	0	-	-	-
	Spanish mackerel*	11	100	0	-	-	-
	spot	0	-	0	-	-	-
	spotted seatrout*	0	-	0	-	-	-
	striped bass*	0	-	0	-	-	-
Fall	weakfish*	0	-	0	-	-	-
	American shad	0	-	0	-	-	-
	Atlantic croaker	0	-	0	-	-	-
	bluefish	3	100	0	-	-	-
	red drum*	0	-	0	-	0	-
	southern flounder*	1	0	1	0	-	-
	southern kingfish	15	60	0	-	-	-
	Spanish mackerel*	0	-	0	-	-	-
	spot	33	6	0	-	-	-
	spotted seatrout*	0	-	0	-	-	-
	striped bass*	0	-	0	-	-	-
	weakfish*	5	80	4	75	-	-

*Size Limits

No size limit for American shad, southern kingfish, Atlantic croaker, bluefish, or spot.; Red drum – 18" TL minimum and 27" TL maximum; Southern flounder – 15" TL minimum; Weakfish – 12" TL minimum; Spotted seatrout – 14" TL minimum; Striped bass – No harvest in Cape Fear River and 18" TL minimum in the Atlantic Ocean, Spanish mackerel-12" TL minimum

Table 22. Annual weighted CPUE (# fish per sample hour) and the associated PSE, total number collected by area, mean size (mm), and size range (mm) for target species in 2011 in the Fisheries Independent Assessment Program (Atlantic Ocean).

Common name	CPUE	PSE*	Total number			Mean size (mm)	Size range (mm)	Average CPUE 2008-2011
			Topsail	Masonboro	Brunswick			
American shad	0.00	-	0	0	0	-	-	<0.01
Atlantic croaker	0.25	40	7	44	6	216	150-236	0.30
bluefish	0.35	60	3	18	7	288	194-350	0.83
red drum	0.00	-	0	0	0	-	-	<0.01
southern flounder	0.03	67	0	3	1	398	312-470	0.04
southern kingfish	0.23	35	4	11	20	285	167-363	0.28
Spanish mackerel	0.34	47	13	6	7	371	272-512	0.45
spot	0.13	69	4	33	0	190	178-205	0.27

Table 22 (Cont.)

Common name	CPUE	PSE*	Total number			Mean size (mm)	Size range (mm)	Average CPUE 2008-2011
			Topsail	Masonboro	Brunswick			
spotted seatrout	0.00	-	0	0	0	-	-	<0.01
striped bass	0.00	-	0	0	0	-	-	0.00
weakfish	0.04	50	0	4	3	332	275-431	0.09

*Percent Standard Error (PSE) is a measure of precision

Table 23. Number of specimens collected from the Fisheries Independent Assessment Program (Atlantic Ocean) for age determination by species in 2011.

Common name	Total
Atlantic croaker	17
bluefish	12
northern kingfish	1
southern flounder	3
southern kingfish	11
Spanish mackerel	6
weakfish	3
Total	53

Table 24. Protected species interactions from July 1, 2011 - June 30, 2012 in the Fisheries Independent Assessment Program (All Areas).

Date	Species	Condition	Water	Location	Latitude	Longitude	Stretch
			depth (feet)				mesh (inch)
6/21/2011	Green turtle	Alive	2.6	Cape Fear	345445	780015	6.0
11/3/2011	Green turtle	Alive	3.6	Cape Fear	340649	775557	4.0
11/15/2011	Atlantic sturgeon*	Alive	2.0	Cape Fear	340015	775611	3.5
3/29/2011	Atlantic sturgeon*	Alive	23.0	Onslow Bay	341944	773958	4.0
7/28/2011	Atlantic sturgeon*	Alive	6.2	Neuse	345538	764648	4.5
12/20/2011	Atlantic sturgeon*	Alive	42.7	Onslow Bay	341653	774158	6.5
3/27/2012	Atlantic sturgeon*	Alive	23	Long Bay	335355	780606	3.0
3/27/2012	Atlantic sturgeon*	Alive	20	Long Bay	335157	780259	5.0
3/27/2012	Atlantic sturgeon*	Alive	23	Long Bay	335355	780606	4.0
3/27/2012	Atlantic sturgeon*	Dead	23	Long Bay	335355	780606	4.0
3/27/2012	Atlantic sturgeon*	Alive	23	Long Bay	335355	780606	5.5
3/27/2012	Atlantic sturgeon*	Dead	23	Long Bay	335355	780606	5.5
4/4/2012	Atlantic sturgeon*	Alive	2.9	Neuse	350106	765342	3.0

*Atlantic sturgeon listed as endangered on April 6, 2012

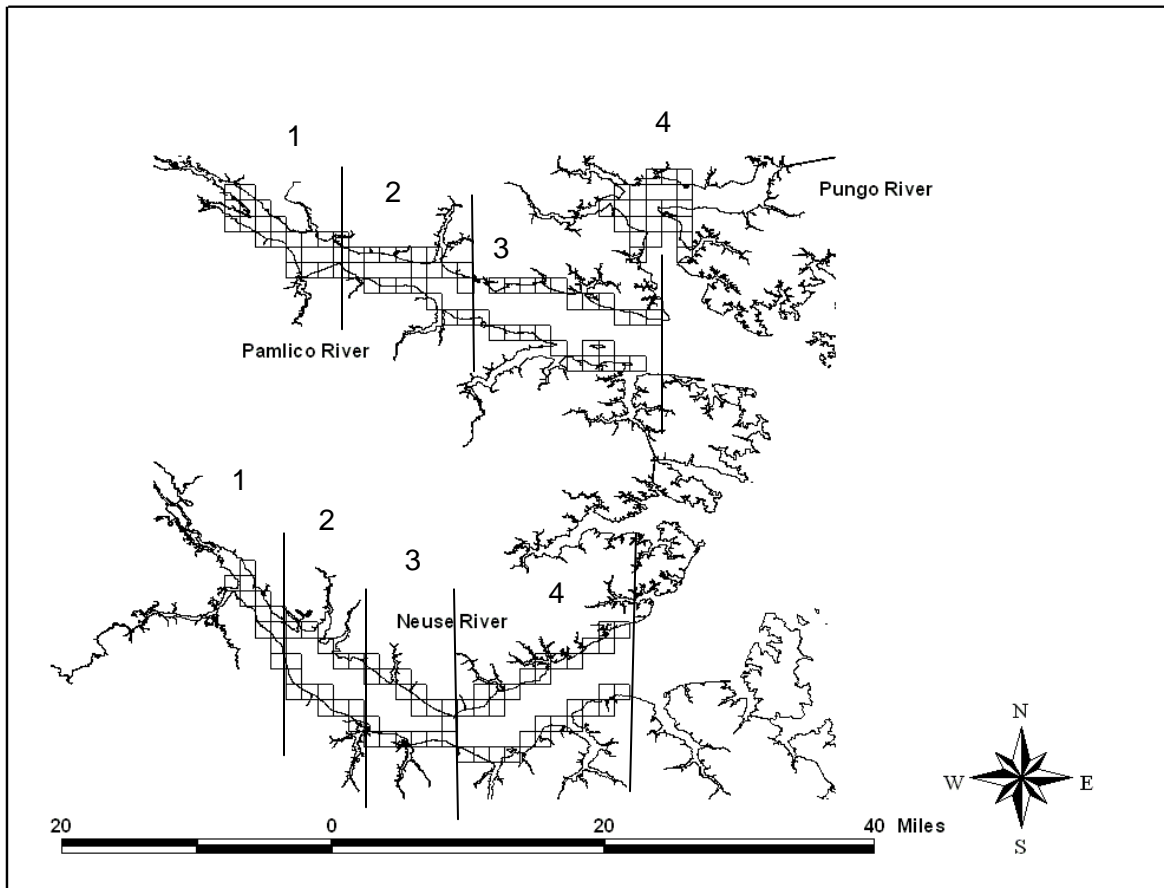


Figure 1. The sample regions and grid system for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) of North Carolina during 2011 with areas numbered (Pamlico/Pungo: 1-Upper, 2-Middle, 3- Lower, 4- Pungo; Neuse: 1-Upper, 2-Upper-middle, 3-Lower-middle, and 4-Lower).

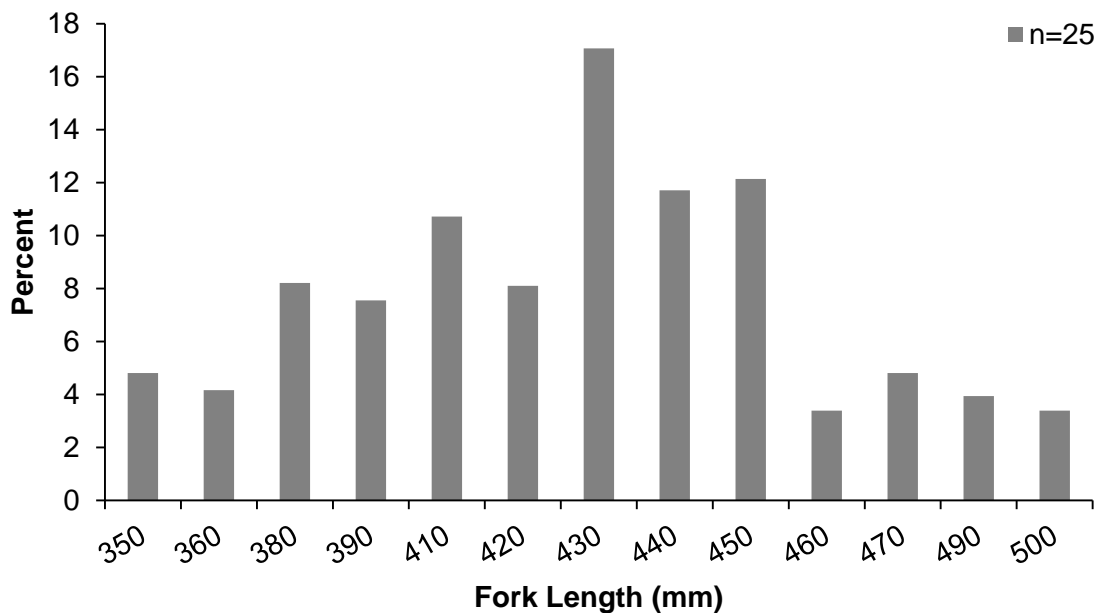


Figure 2. American shad (*Alosa sapidissima*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) 2011.

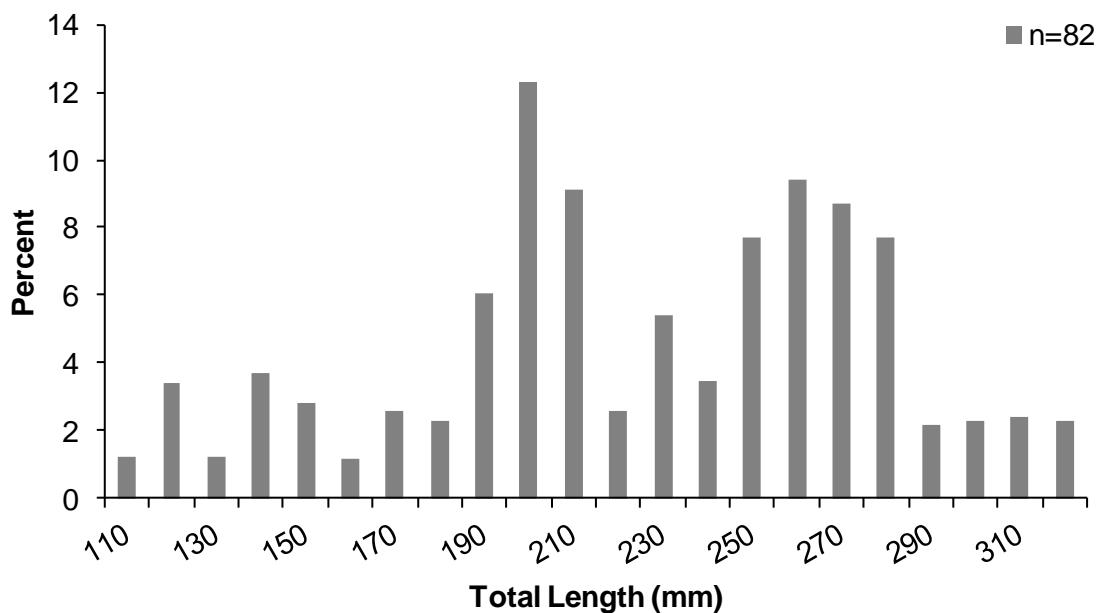


Figure 3. Atlantic croaker (*Micropogonias undulatus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) 2011.

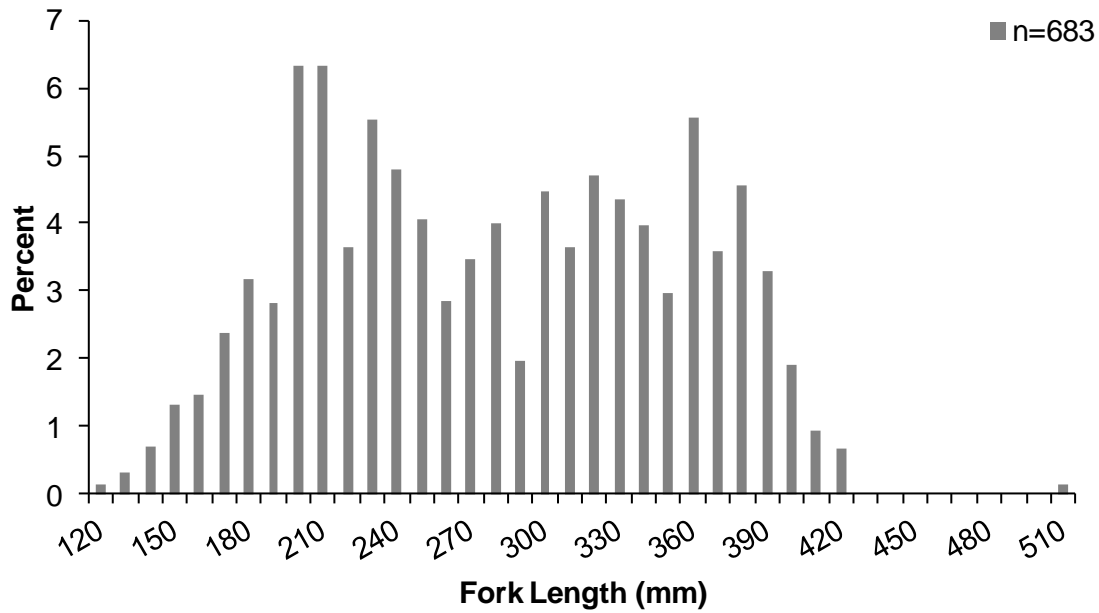


Figure 4. Bluefish (*Pomatomus saltatrix*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) 2011.

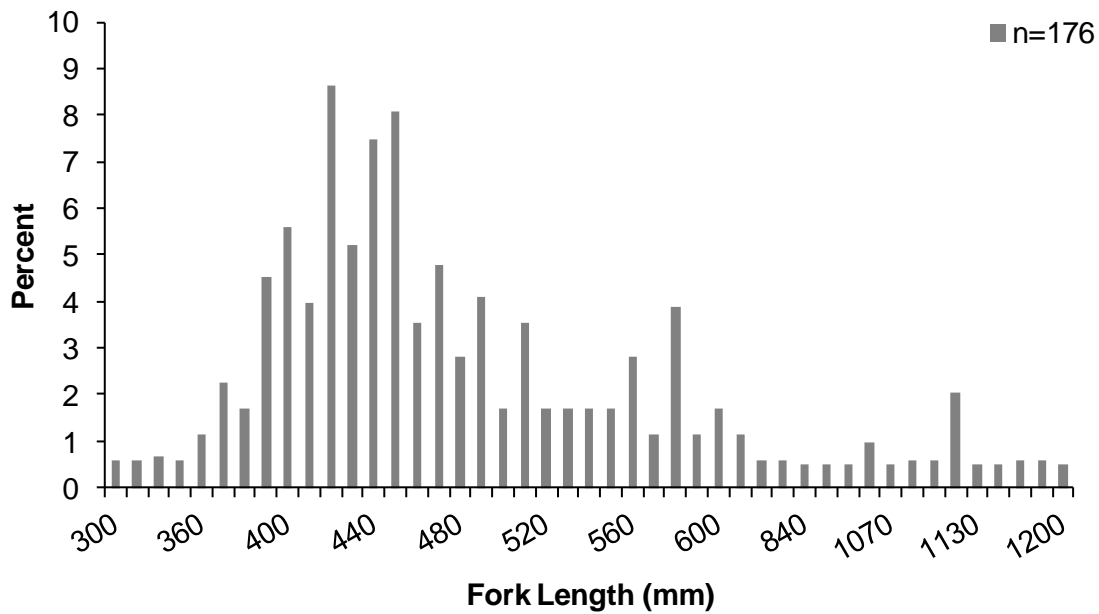


Figure 5. Red drum (*Sciaenops ocellatus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) 2011.

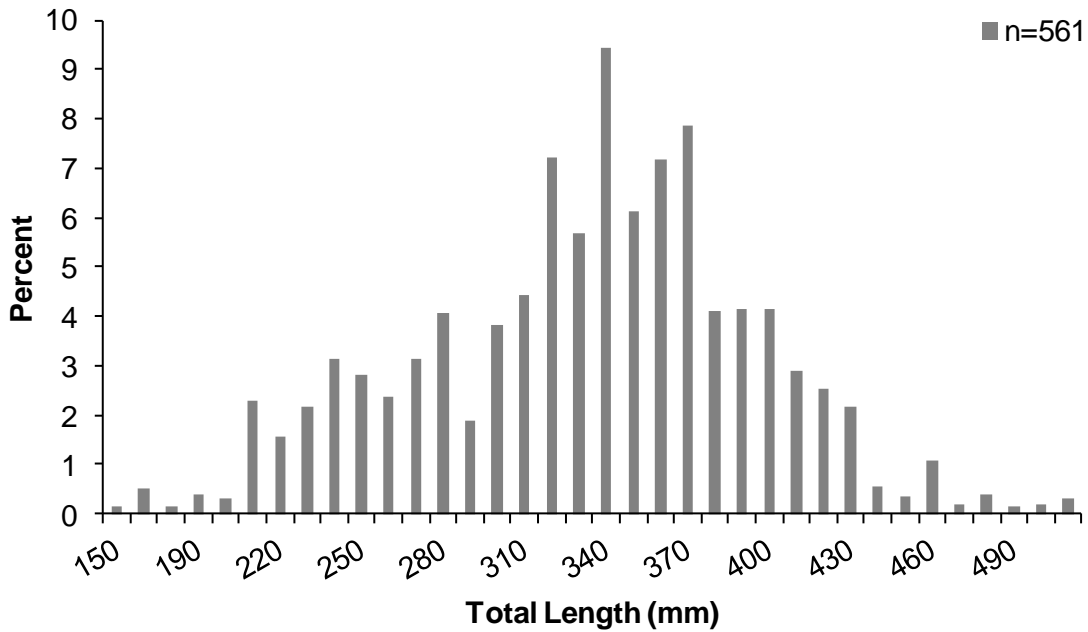


Figure 6. Southern flounder (*Paralichthys lethostigma*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) 2011.

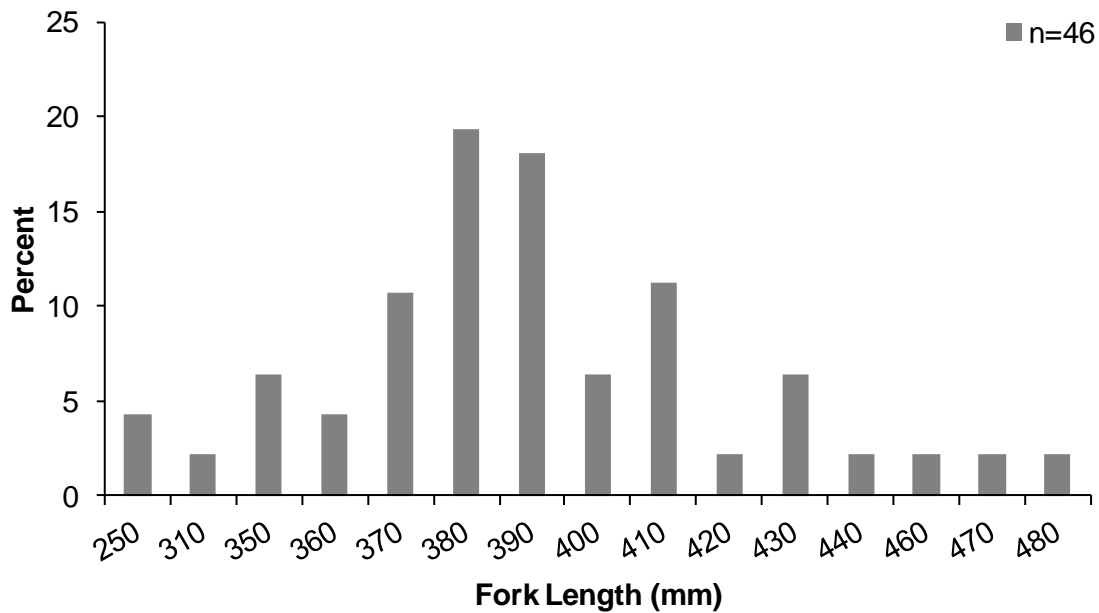


Figure 7. Spanish mackerel (*Scomberomorus maculatus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) 2011.

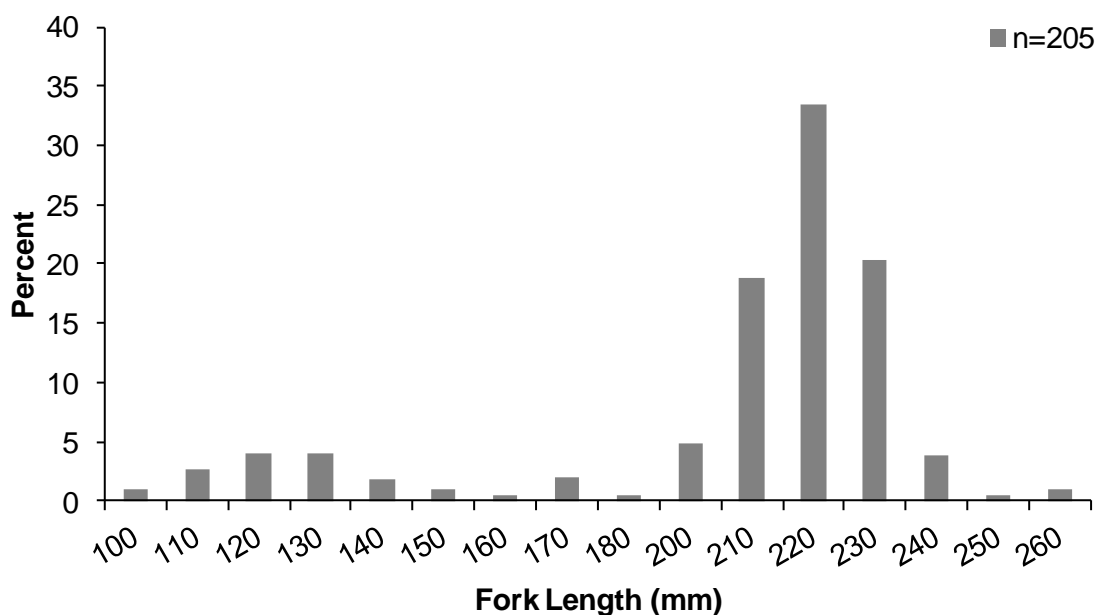


Figure 8. Spot (*Leiostomus xanthurus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) 2011.

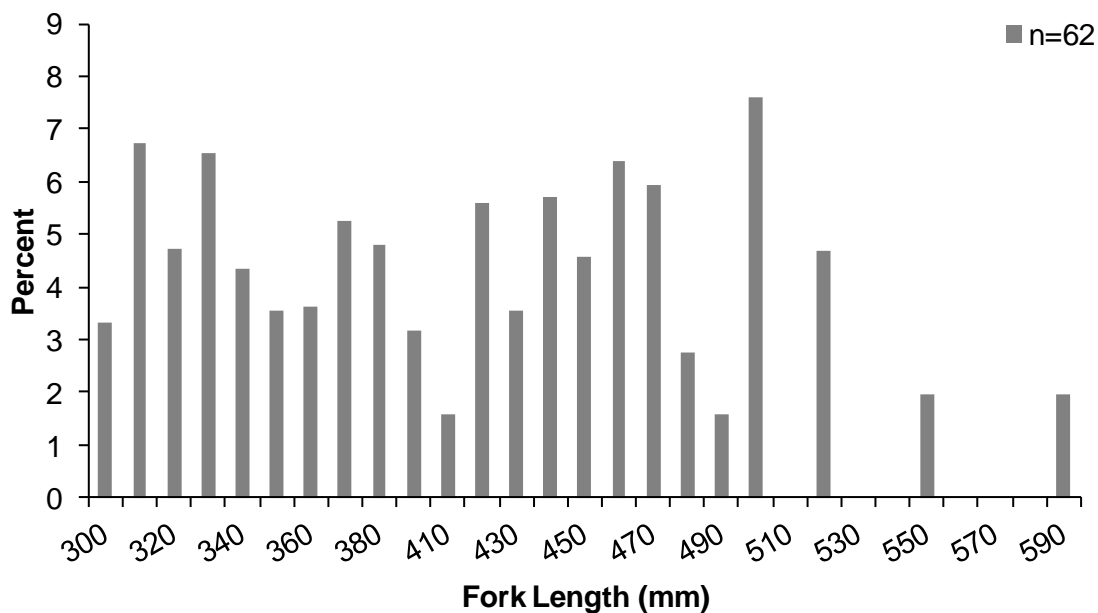


Figure 9. Spotted seatrout (*Cynoscion nebulosus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) 2011.

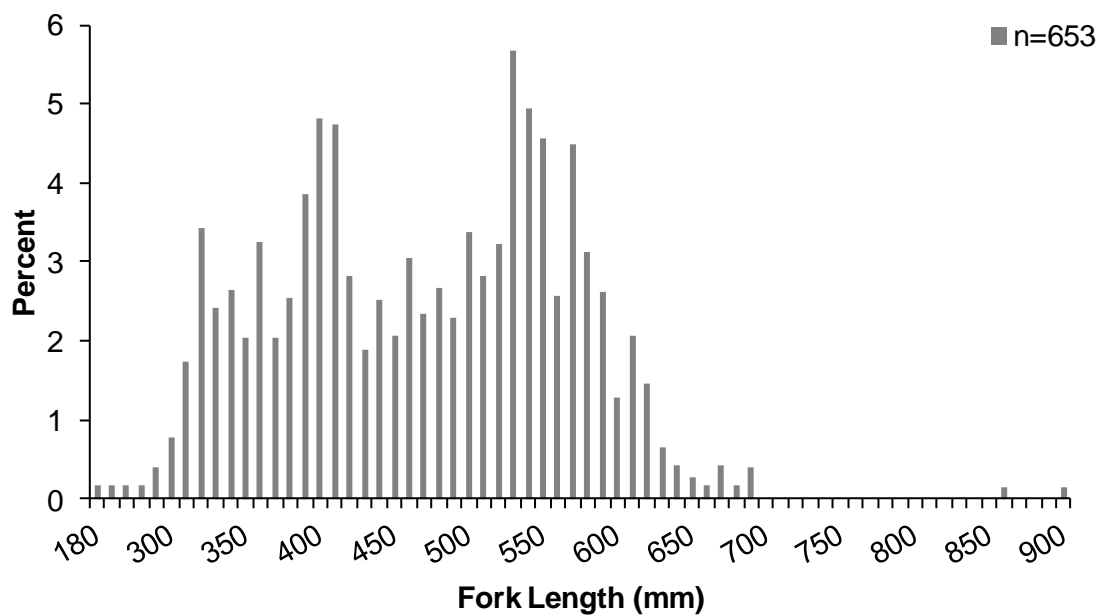


Figure 10. Striped bass (*Morone saxatilis*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) 2011.

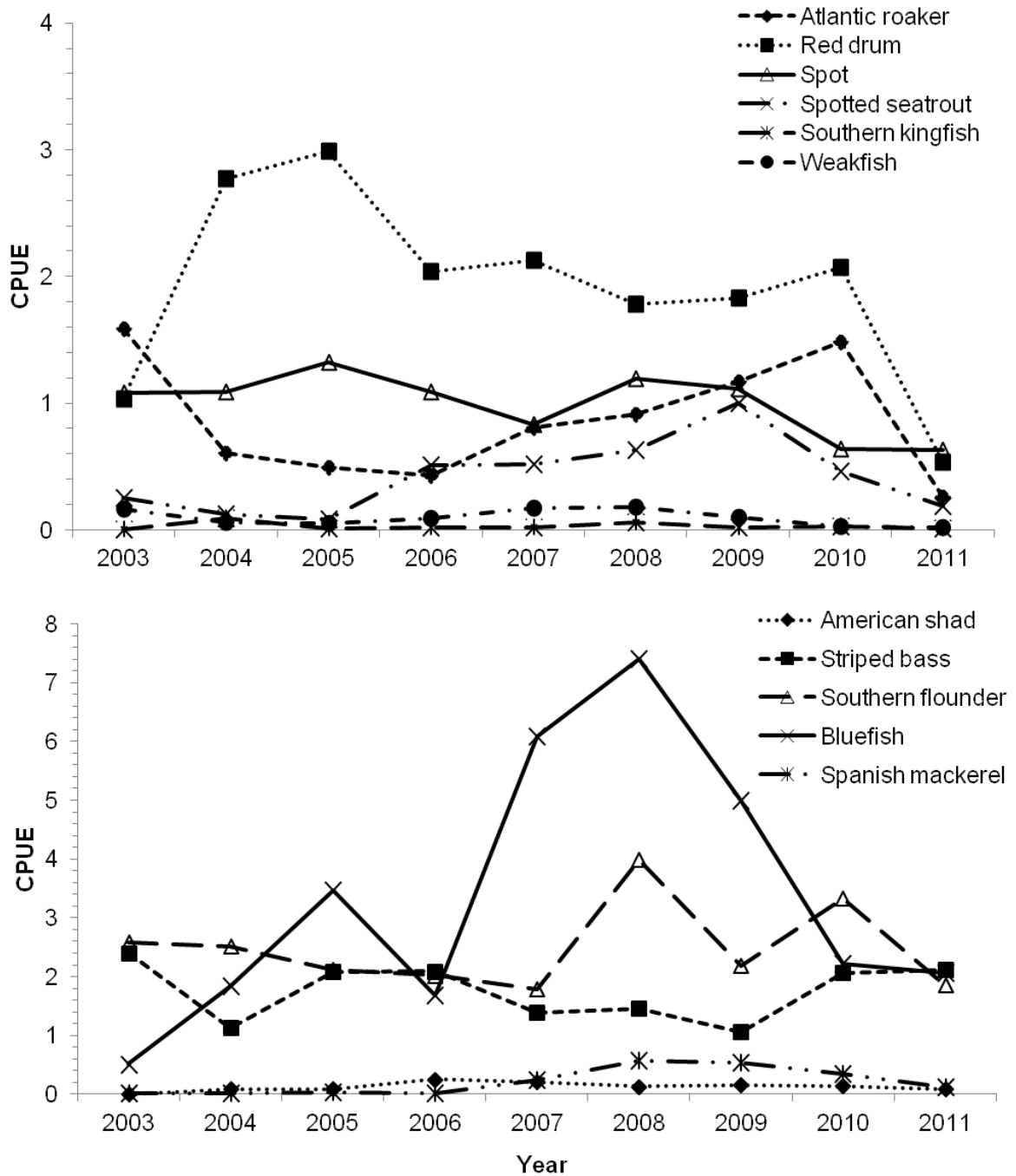


Figure 11. Annual weighted CPUE (individuals per sample) for target species from 2003 to 2011 in the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers).

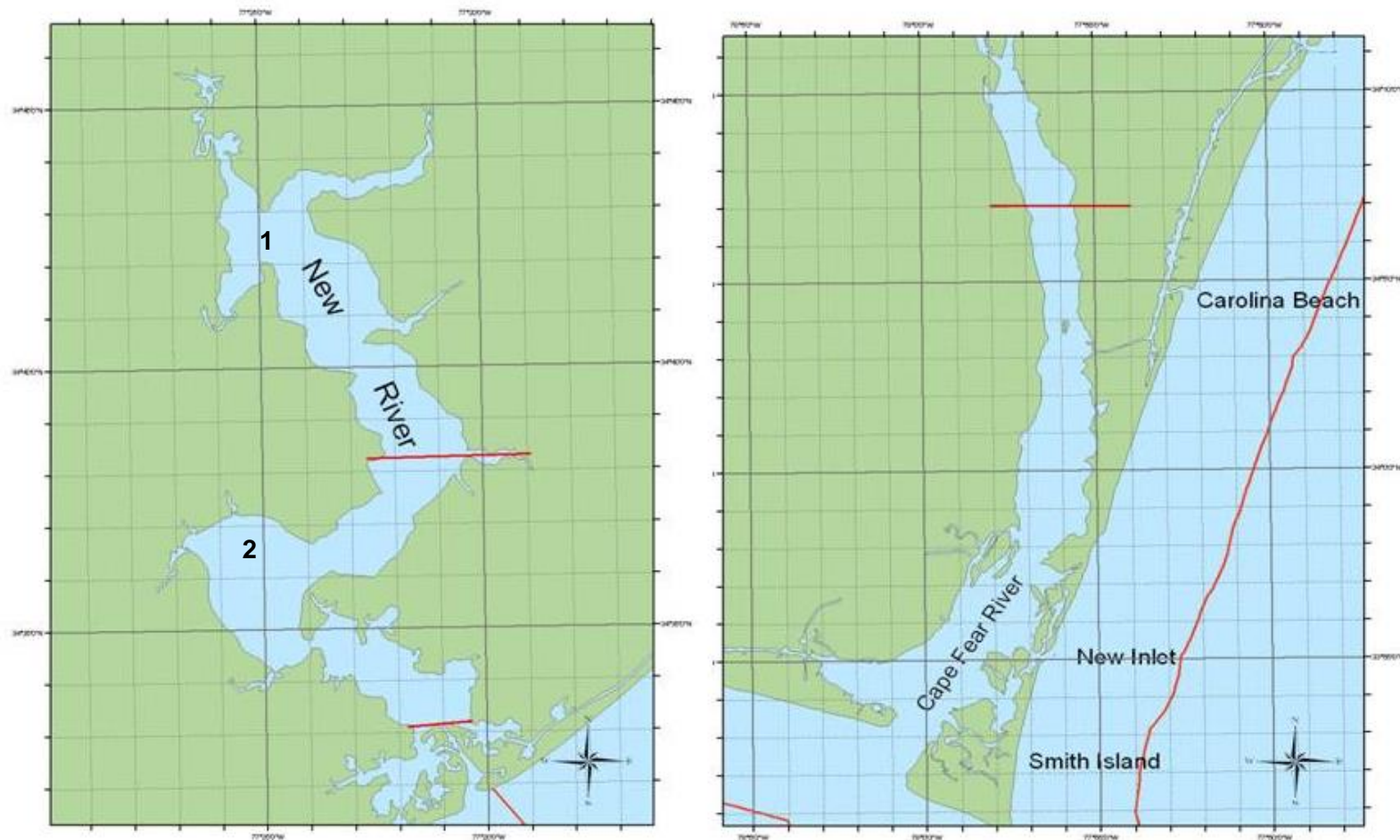


Figure 12. The sample regions and grid system for the Fisheries Independent Assessment Program (New and Cape Fear rivers) of North Carolina during 2011 with areas numbered (New: 1-Upper, 2-Lower; Cape Fear).

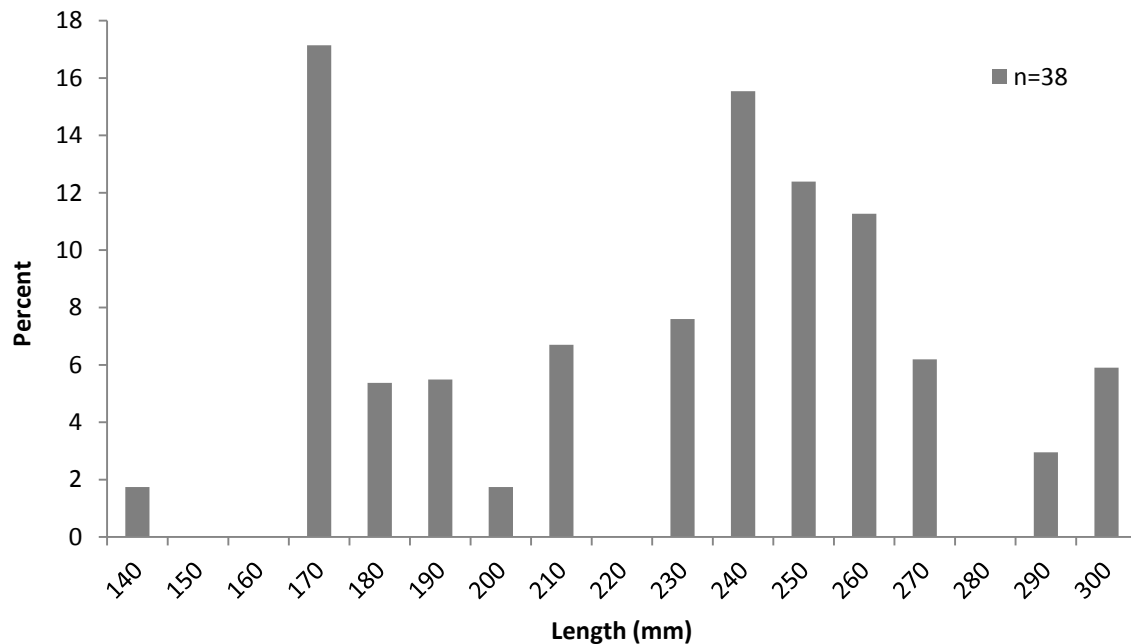


Figure 13. Atlantic croaker (*Micropogonias undulatus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (New and Cape Fear rivers) in 2011.

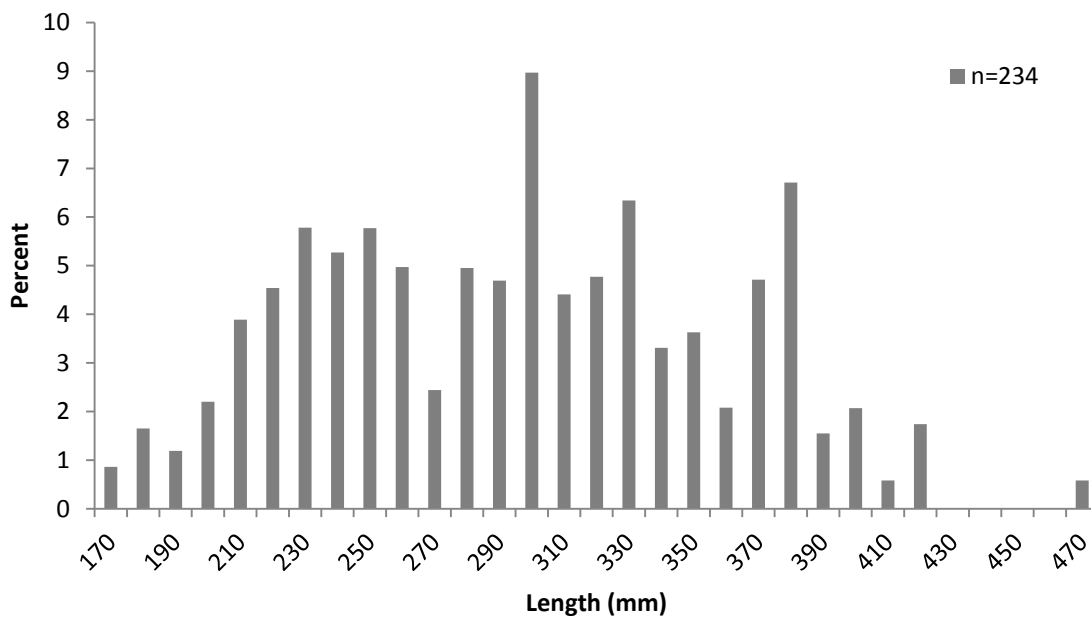


Figure 14. Bluefish (*Pomatomus saltatrix*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (New and Cape Fear rivers) in 2011.

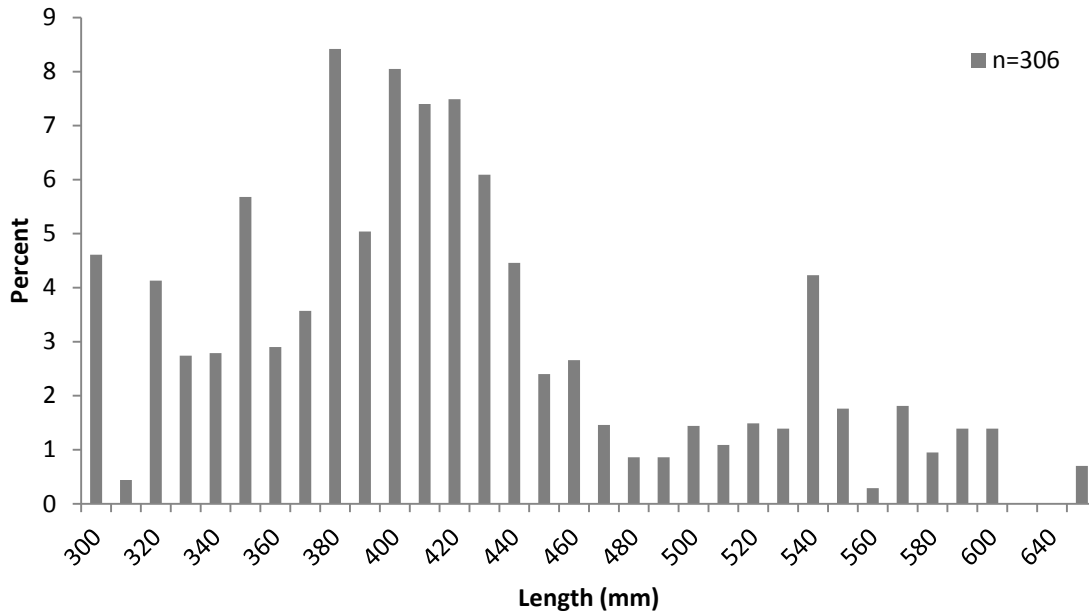


Figure 15. Red drum (*Sciaenops ocellatus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (New and Cape Fear rivers) in 2011.

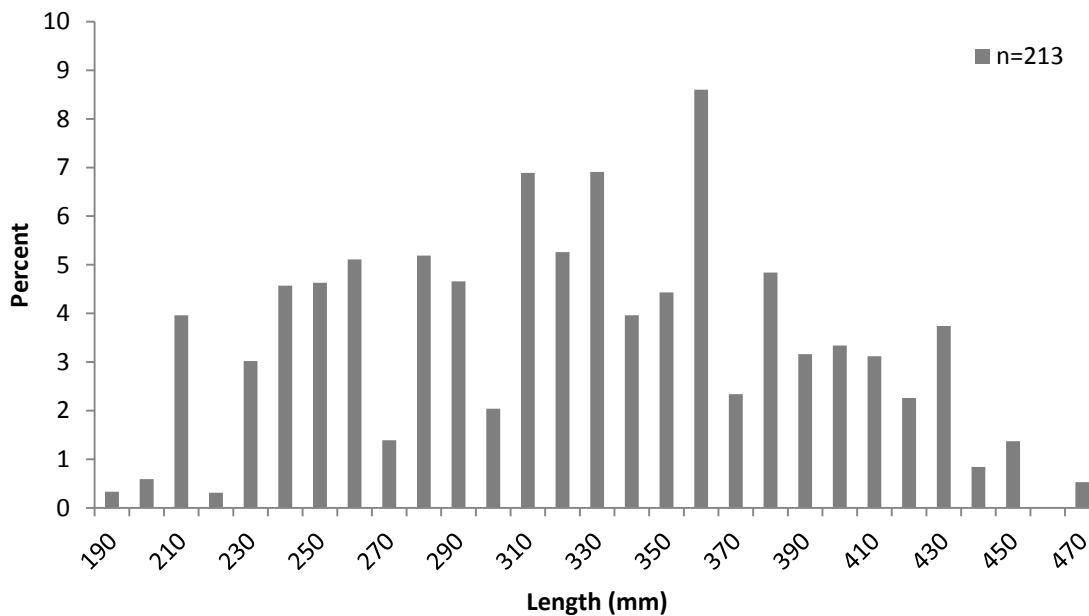


Figure 16. Southern flounder (*Paralichthys lethostigma*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (New and Cape Fear rivers) in 2011.

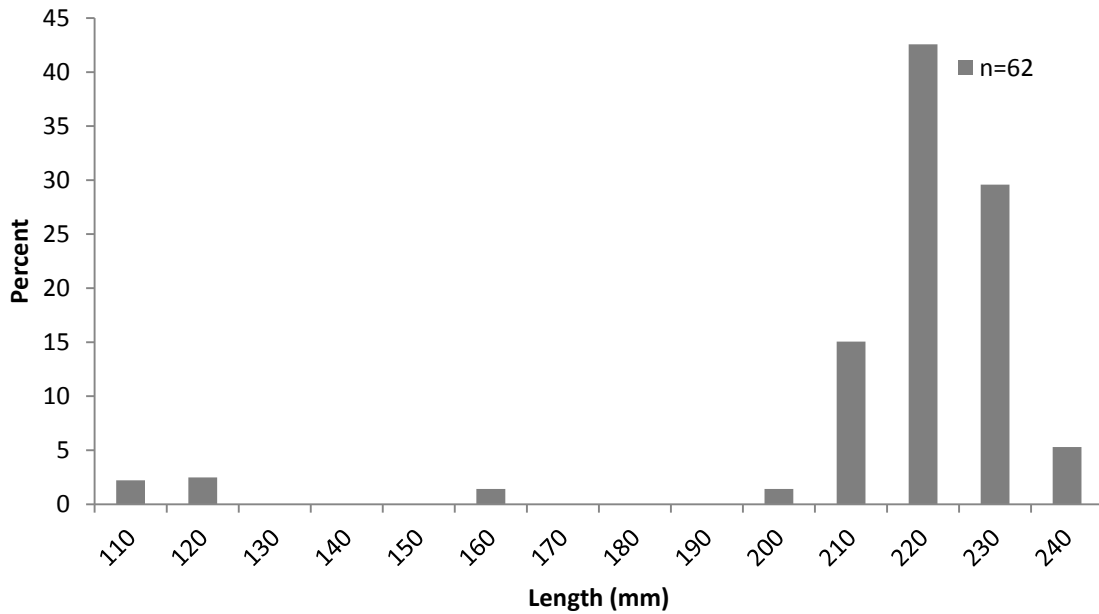


Figure 17. Spot (*Leiostomus xanthurus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (New and Cape Fear rivers) in 2011.

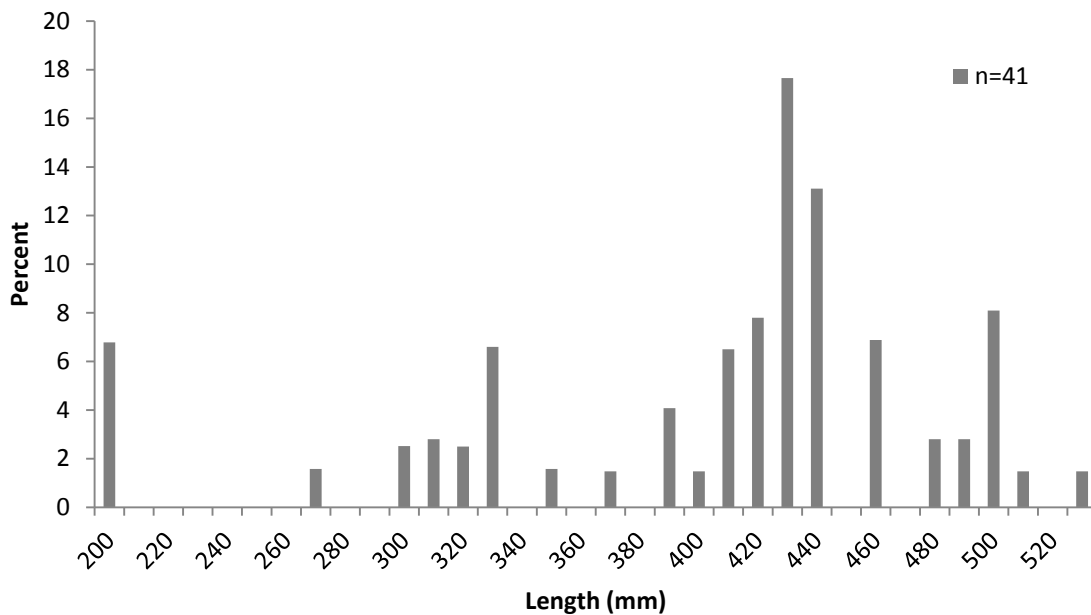


Figure 178. Spotted seatrout (*Cynoscion nebulosus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (New and Cape Fear rivers) in 2011.

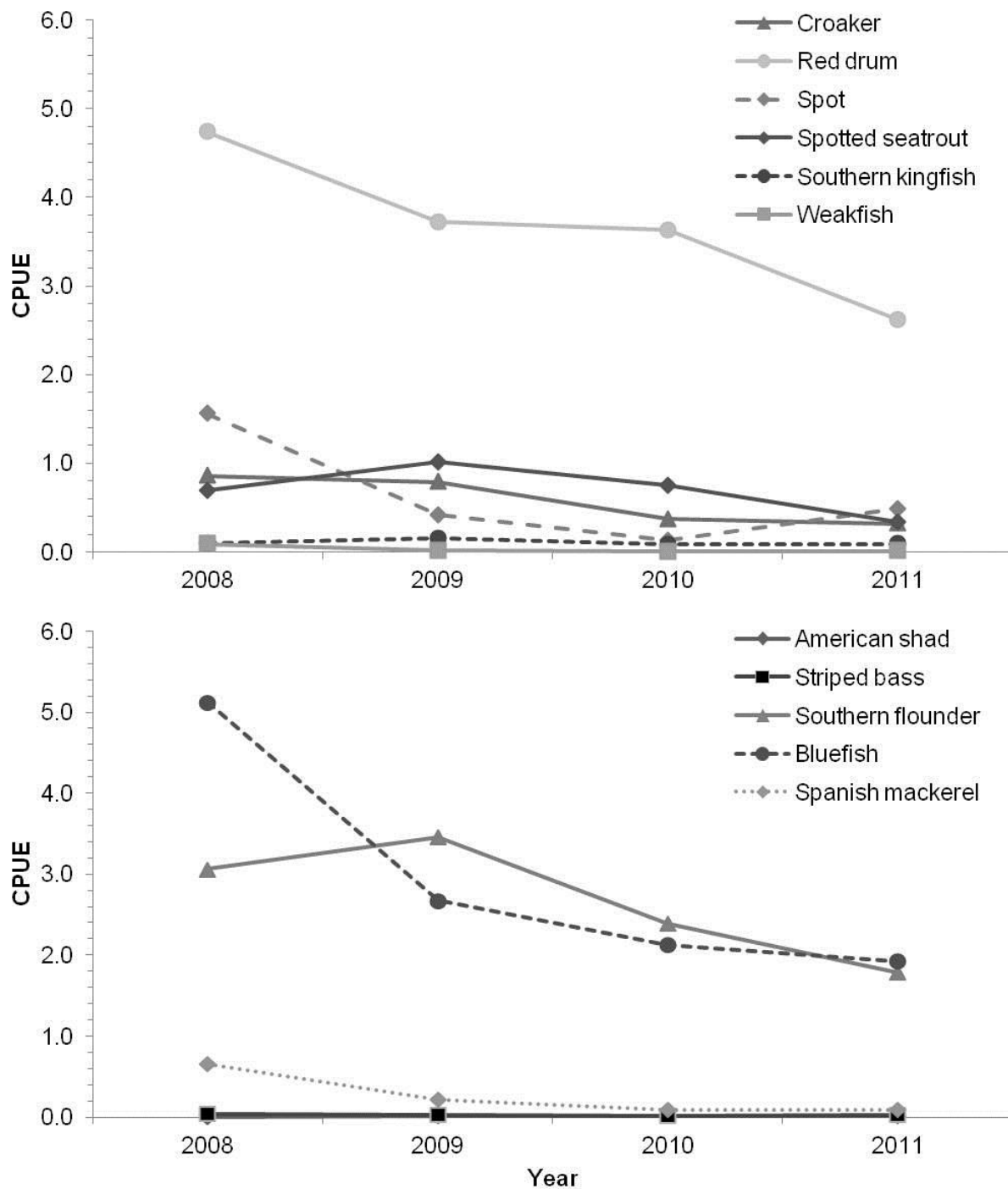


Figure 18. Annual weighted CPUE (individuals per sample) for target species from 2008 to 2011 in the Fisheries Independent Assessment Program (Cape Fear and New rivers).

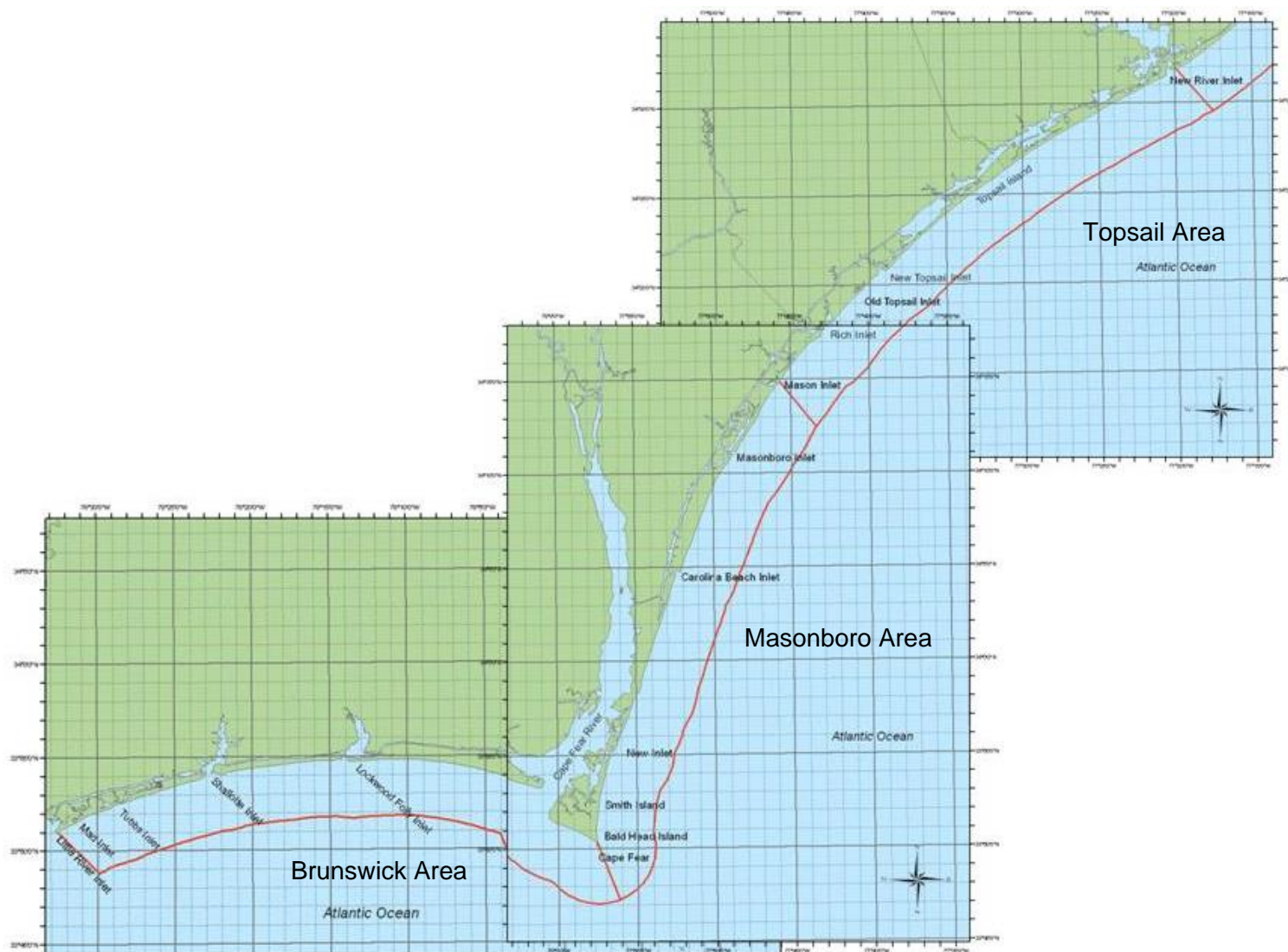


Figure 19. The sample regions and grid system for the Fisheries Independent Assessment Program (Atlantic Ocean) of North Carolina during 2011 including the Topsail, Masonboro, and Brunswick areas.

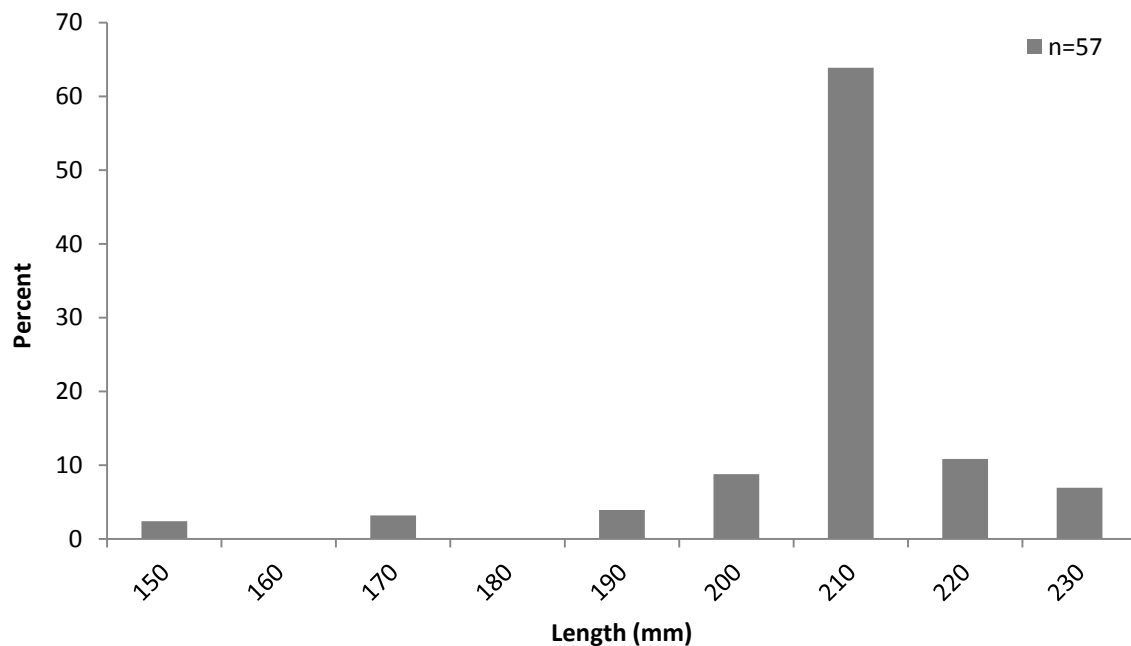


Figure 20. Atlantic croaker (*Micropogonias undulatus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Atlantic Ocean) in 2011.

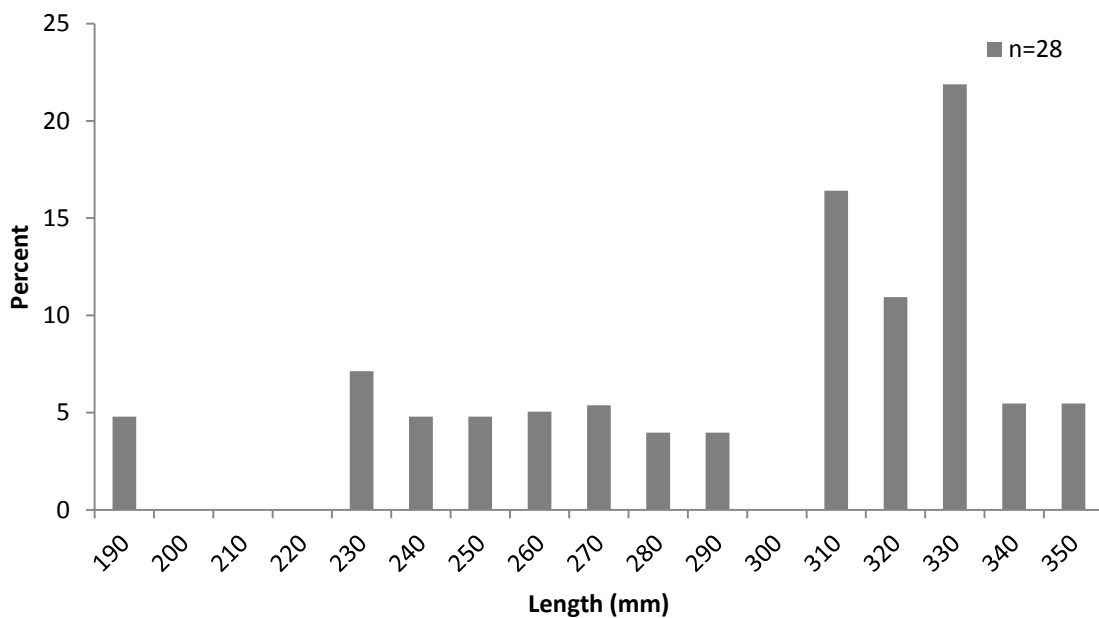


Figure 21. Bluefish (*Pomatomus saltatrix*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Atlantic Ocean) in 2011.

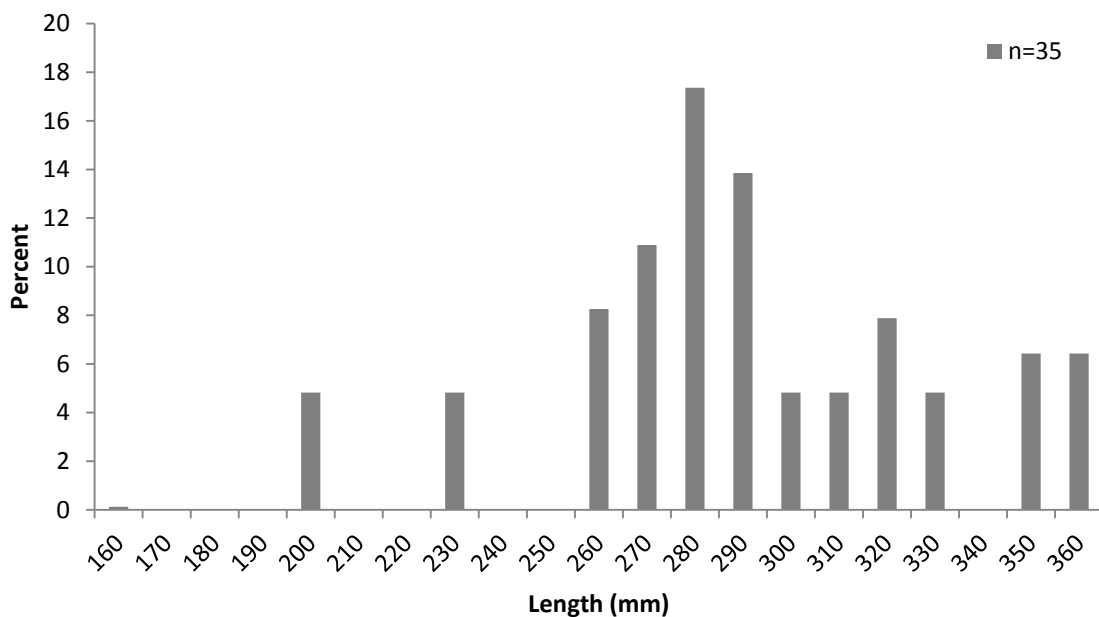


Figure 22. Southern kingfish (*Menticirrhus americanus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Atlantic Ocean) in 2011.

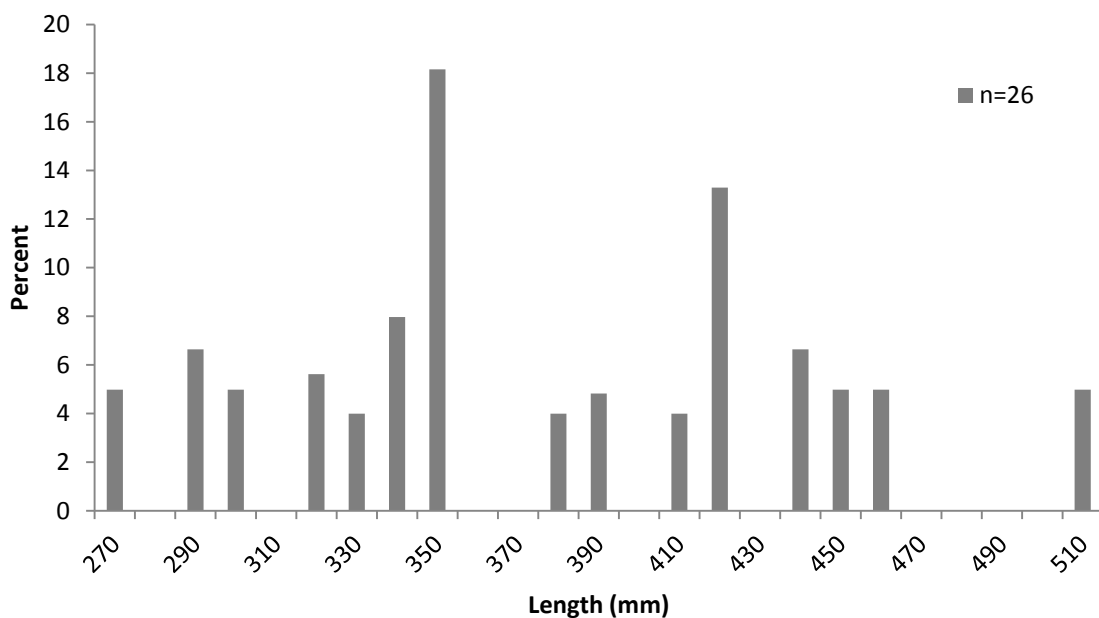


Figure 23. Spanish mackerel (*Scomberomorus maculatus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Atlantic Ocean) in 2011.

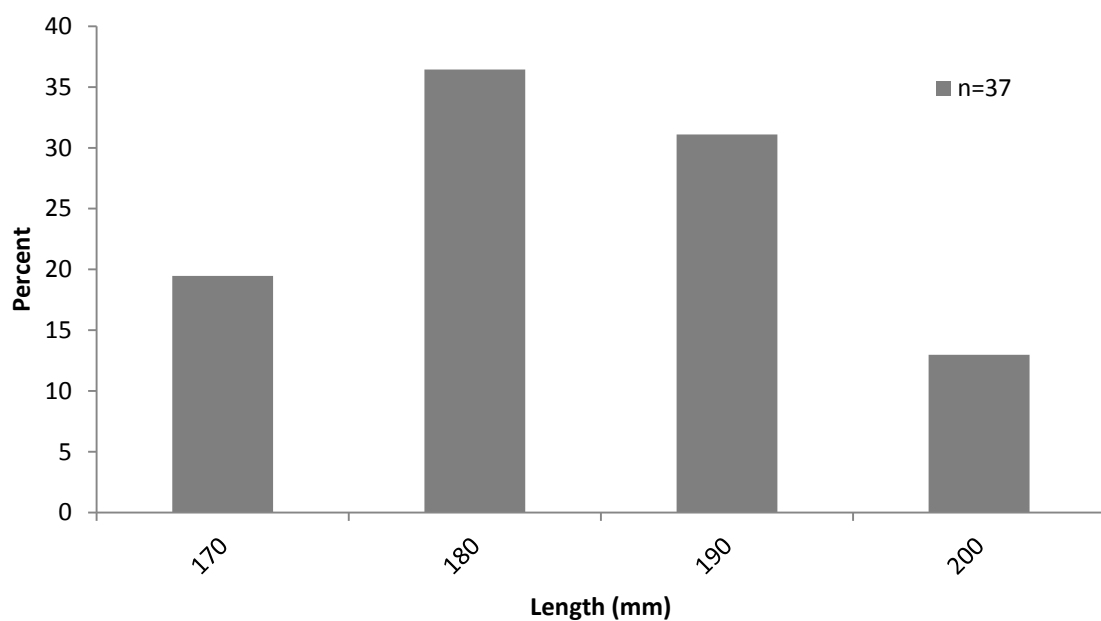


Figure 24. Spot (*Leiostomus xanthurus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Atlantic Ocean) in 2011.

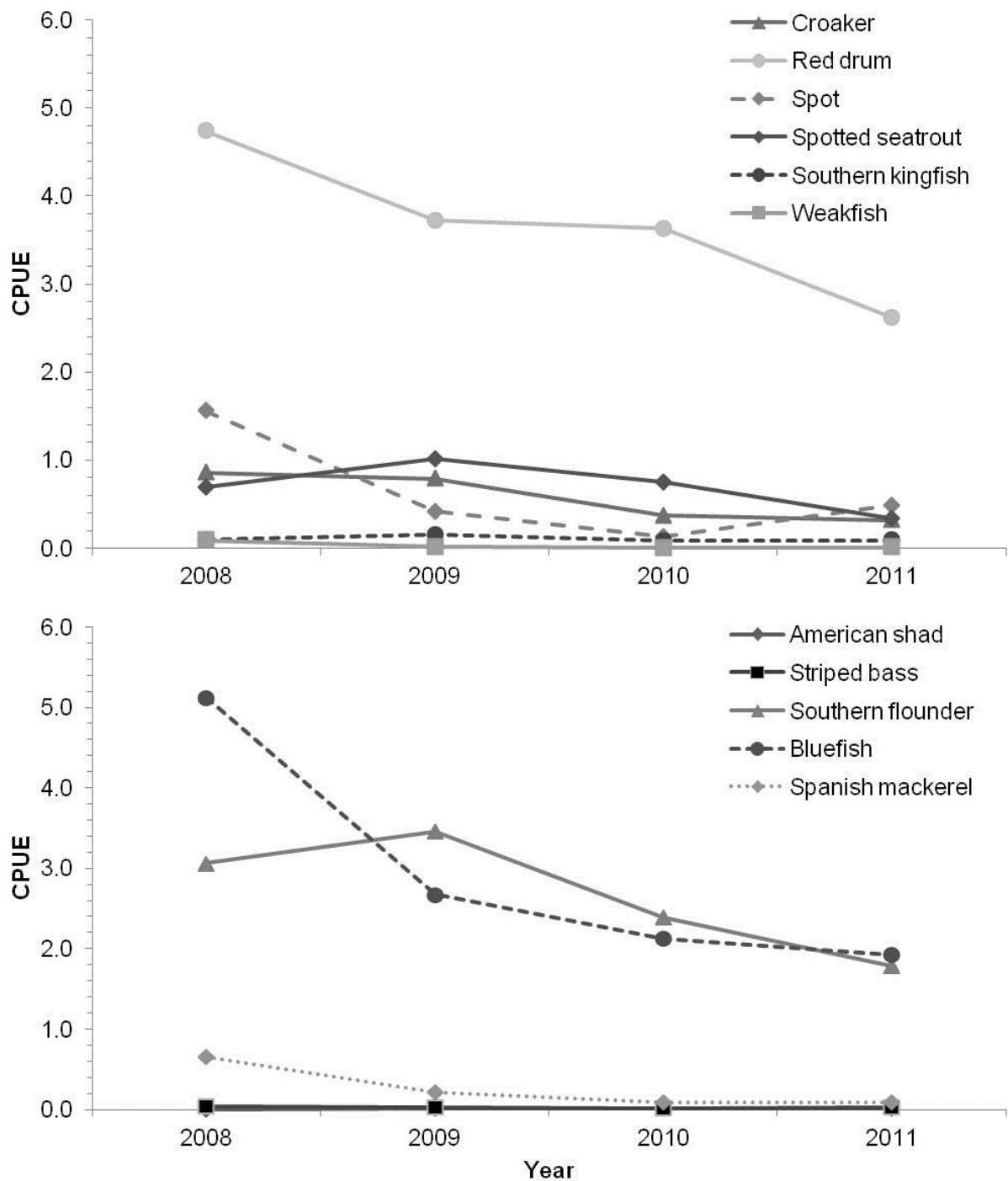


Figure 25. Annual weighted CPUE (number of individuals per sample hour) for target species from 2008 to 2011 in the Fisheries Independent Assessment Program (Atlantic Ocean).

APPENDIX

The following procedures were followed to produce the weighted CPUE estimates by length and age. The annual abundance index calculation for each target species was as follows:

- 1) Pool all of a species records across mesh sizes for each sample.
- 2) Compute a length frequency distribution for that species to obtain a number at each size class ($S_{szclass}$). In cases where subsampling occurred the total number of measured fish was expanded to the total catch. Any non-measurable fish (i.e. parts) were distributed proportionately across all size classes of a given species.
- 3) Sum all the $S_{szclass}$ for all strata by region ($T_{szclass \text{ by SR}}$).
- 4) For all strata by region divide the $T_{szclass}$ by the total number of sampling trips that occurred (T_{SR}) to obtain a catch estimate by size class (mean and standard deviation) for each strata by region ($S_{szclass \text{ by SR}}$). All effort, including samples with zero catch, was factored into the index.
- 5) Multiply the $S_{szclass \text{ by SR}}$ by the total number of grids occurring in all strata by region ($TG_{by SR}$) to obtain a weighted estimate for each size class ($WS_{szclass \text{ by SR}}$).
- 6) Sum all $WS_{szclass \text{ by SR}}$ by species (SW_{all}).
- 7) Divide SW_{all} by the total number of grids in all areas sampled to obtain a project-wide weight catch at length estimate for each species.
- 8) The overall annual CPUE by species is calculated by summing the catch-at-length estimates for each species across all available lengths.